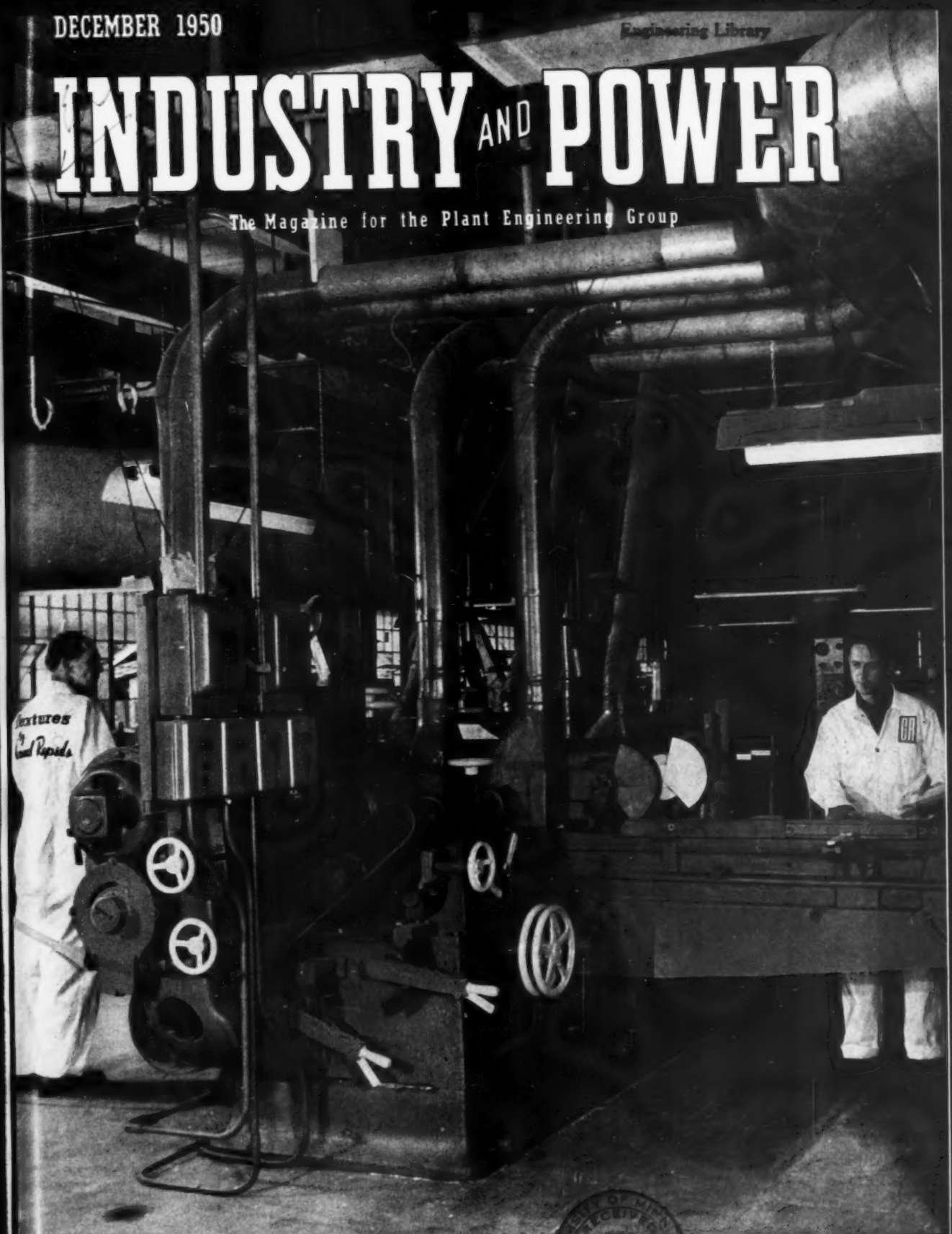
Engineering Library

DECEMBER 1950

INDUSTRY AND POWER

The Magazine for the Plant Engineering Group



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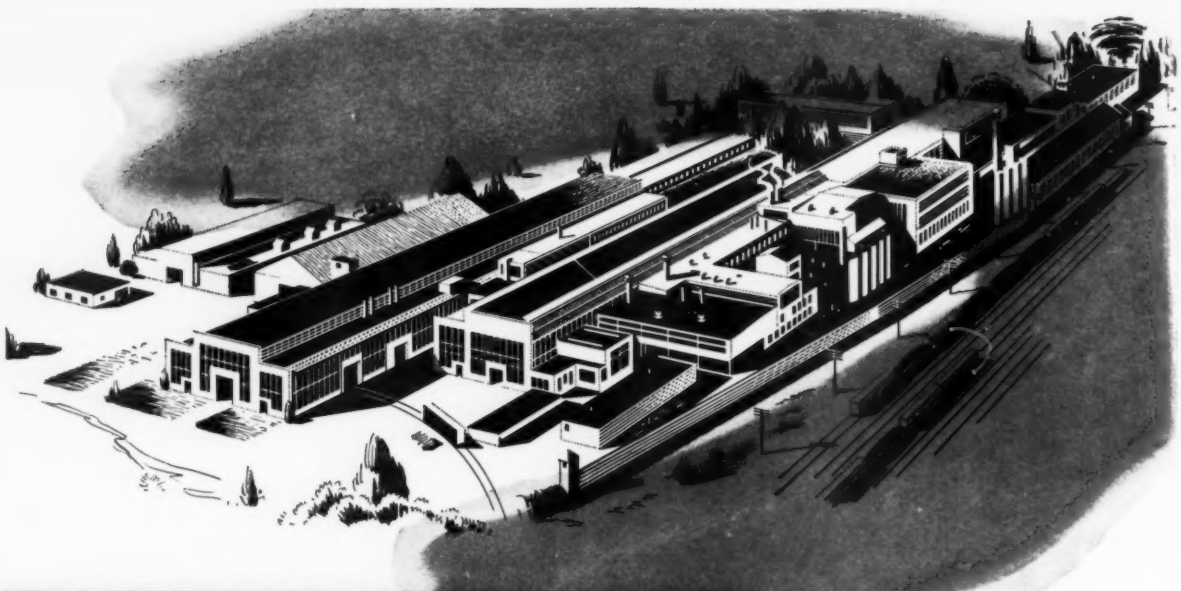

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INDUSTRY AND POWER

The Magazine for the Plant Engineering Group

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Established May, 1920

Member Controlled Circulation Audit and National Business Publications, Inc.

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INDUSTRY and POWER, including INDUSTRIAL POWER, is published monthly at St. Joseph, Michigan. Accepted under the act of June 5, 1934, authorized August 31, 1942.

Cover Illustration

Dust created by woodworking machines at the Grand Rapids Store Equipment Co. is carried off through a network of piping to "Dustube" collectors mounted outside the first floor.

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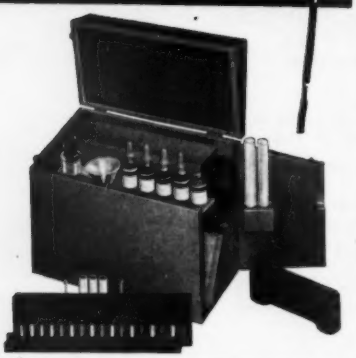
CONTROL of Scale begins with pH and PHOSPHATE DETERMINATIONS



BOILER WATER COMPARATORS

Model P contains either High or Low Phosphate Comparator. Model W contains same plus 3 pH slides (pH 7.2 to 8.8); (pH 8.6—10.2); (pH 10—11.6) and accessories.

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Because Taylor Boiler Water Comparators bring accurate pH and Phosphate determinations down to a simple one or two minute operation, they have become the accepted standard tool throughout industry. Taylor sets give maximum convenience since all liquid color standards necessary for a determination are enclosed in a rugged plastic slide. There are no fragile single standards to handle. You are assured of maximum accuracy because all the Taylor Liquid Color standards carry an unlimited guarantee against fading.

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Acorns of Science

Developments not yet available, but of interest to the Plant Engineering Group as previews of future tools and methods

Amplification Without Tubes

• Improved methods have produced Hypernic V at the Westinghouse Electric Corp. and it is now commercially available as toroidal cores. The exceptionally steep magnetization curve has made development of magnetic amplifiers with an amplification factor as high as 1,000,000 possible.

Improvements are expected to make these high-gain units commercially available for low frequency use (up to 10 kc). They may gradually replace vacuum-tube amplifiers under service conditions where extreme reliability is needed or where mechanical shock is a constant possibility.

Improvements in Bolted Joints

• Research at Purdue University under the auspices of the Association of American Railroads may affect future design of bolt holes and bolts and result in joints having higher fatigue strength. The investigations indicate that the holes should have enough clearance that sides of the bolts never bear on the metal of the joint. High strength bolts are desirable and should be tightened enough under controlled torque so that the tendency of the joint components to slip is restrained by friction only.

Clamping force of the bolt produces compression stresses at the edge of the hole and appears to improve fatigue life. The hole should be reamed and the edges beveled to remove stress risers on those surfaces. Heavy spring washers may also be desirable. Investigations on optimum conditions continue.

Balance Gives Air-Flow Data

• Constructed with self-contained strain gages, this 10-in. long, 3-lb unit can be installed inside aerodynamic wind tunnel models, obviating the strut connections of former balances. Struts tend to invalidate test results when air flow approaches the speed of sound. Also, direct meter readings are obtained from the strain gages for each of the six components, consisting of forces in each of the three directions and the tendency to twist from each direction, which act on the model. Information is immediately available and days of calculations are saved.

Data obtained with the inexpensive balance, which was developed by The Glenn L. Martin Co. for aircraft research, will greatly extend knowledge on both subsonic and supersonic gas flow. The results may be expected to produce more efficient gas and steam turbines and auxiliary equipment in the future of power sources.

Metals Plus Ceramics

• These substances, which can be combined only by techniques of powder metallurgy, form a group of materials remotely related to the sintered carbides. However, they withstand higher temperatures and show superior resistance to oxidation and general atmospheric attack. Aluminum oxide in a matrix of cobalt or other high melting metal is a typical composition of the material.

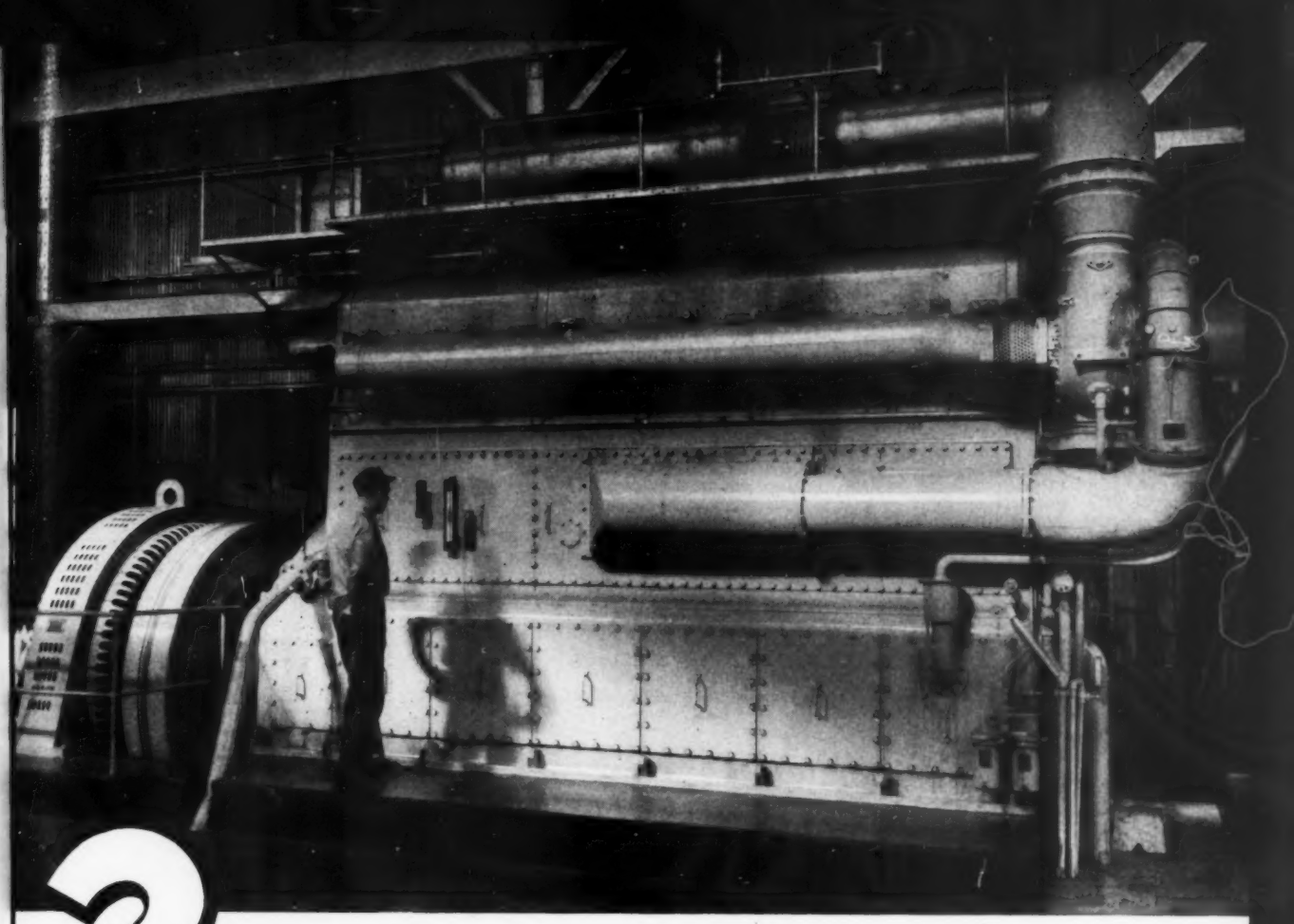
Although the materials are now quite expensive, Westinghouse Electric Corp. engineers are learning more about their properties and expect to obtain costs which will allow them to be applied economically to high temperature devices. They are also expected to have considerable effect on high temperature turbines and combustion surfaces requiring heat resistance.

Watch Titanium

• Development work on this abundant metal in a number of laboratories parallels the history of aluminum. Better alloys at prices that will make them commercially available in quantity are being sought and obtained.

Ductile, workable alloys with strengths of about 150,000 psi have been announced. They are somewhat heavier than the aluminum alloys but only about half the weight of steels. Developments promise a titanium alloy with a strength-weight ratio higher than any now commercially known.

The alloys are corrosion resistant and have superior performance at elevated temperatures. Lower costs will make these excellent properties available for many structural and machine parts.



3rd NORDBERG for Miami plant of ARIZONA EDISON CO., INC.

. . . purchased as a result of the excellent performance of their first two engines

EARLY in 1948, the Arizona Edison Co., Inc. installed this Nordberg Duafuel Diesel Engine in their Miami, Arizona, plant . . . a 6-cylinder, 4-cycle supercharged unit having a sea level rating of 1220 hp at 327 rpm, driving an 800 kw AC generator. In 1949, a second Nordberg Duafuel Engine was installed . . . an 8-cylinder 1750 hp supercharged unit, driving a 1235 kw AC generator.

These first two Nordberg Duafuel Engines were operated "around the clock", and, because of their excellent performance, a third Nordberg Duafuel unit has now been purchased . . . identical to the second engine installed.

Here, then, is *repeat order proof* that Nordberg Duafuel Diesels deliver the kind of dependable performance you need for central station service. Write for details on Nordberg engines to meet your needs . . . sizes from 10 to 9600 hp.

NORDBERG MFG. CO., Milwaukee 7, Wis.

9850

BUSCH-SULZER
A DIVISION OF NORDBERG

NORDBERG
DIESEL ENGINES

new equipment and developments

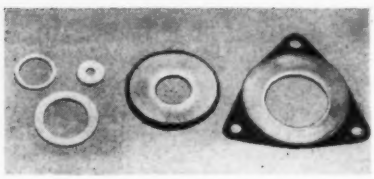
You can easily get more data on these new equipment and development items. Use the handy, postage-free order cards on Page 101. Just list the key numbers of the descriptive paragraphs in the spaces provided on the card and mail.

301—HIGH PRESSURE FORGED STEEL TRAPS

Small forged steel steam traps—developed by the V. D. Anderson Co. for high pressure, super-heated steam service—are suitable for steam pressures up to 500 psi with 800 F TT. These units have unusual safety features as the head and body are of forged steel to withstand shock and explosions. The internal parts are of stainless steel with valve and seat made of a special alloy. Made in two principal types, No. 340 is installed straight-in-line or as an elbow eliminating nipples and fittings, No. 60, is designed with the inlet in the bottom and the outlet in the top for a vertical installation.

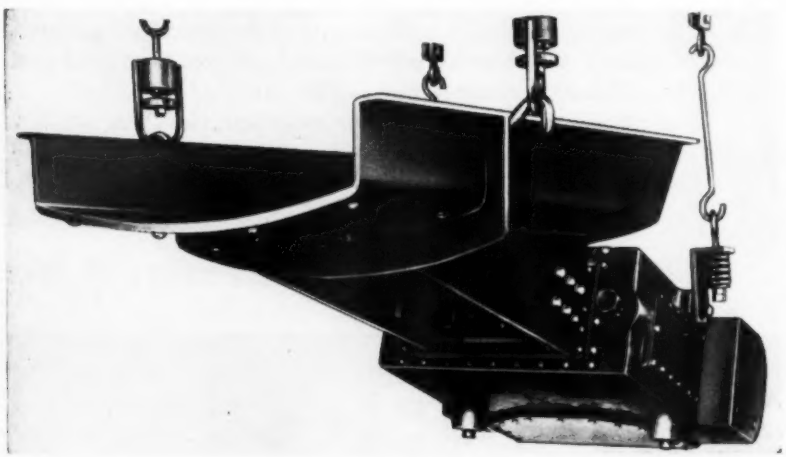
302—TEFLON GASKETS ARE CHEMICAL RESISTANT

Introduction of an extensive new line of gaskets fabricated from "Teflon" is announced by Chicago Gasket Co. identified by the trade name "KORDA". Teflon, a heavy-duty plastic, has excellent heat resistance and has been tested in over 200 different strong acids, caustic alkalies, and solvents. It is completely unaffected by all except molten sodium and fluorine at elevated temperatures and pressures. Several new features are incorporated into these gaskets including a seamless, one-piece, precision-machined jacket assuring a perfect seal and heavier wall on the inside diameter of the gasket. This gives added strength at this point of strain where the fluid handled is in contact with the gasket.



303—VIBRATOR FEEDER IS DUST TIGHT

Syntron Co. has announced the addition of a dust-tight vibratory feeder to their line. The working parts—leaf springs, armature and core—are covered by gasket-sealed plates bolted to the magnet casting. By enclosing these parts, protection is obtained against clogging by excessive supply hopper spillage or heavy dust conditions. The feeder is suitable for Class 2, Group installations. Addition of this sealed protection does not affect the feed rate, which ranges up to hundreds of ton per hour of bulk—dry or damp—hot or cold—fine or coarse materials.



304—AIR MOTOR FEATURES VARIABLE SPEED

Rotary-vane air motor now in production at Gast Mfg. Corp. offers the advantages of variable-speed drive with simple valve control, explosion-proof safety in hazardous locations and proof against damage when slowed or stalled by overloads. Operating range of this model is from ½ hp at 500 rpm to 3 hp at 1500 rpm for the reversible type. Non-reversible models deliver up to 4 hp. Adaptable for air pressure from 30 to 80 psi the motor uses from 20 to 100 cfm depending on speed and load. Unusually light and compact for its power, this ½ to 4 hp motor weighs only 25 lb.

305—HOIST HAS RAPID LIFTING RATE

Weighing only one-half as much as conventional hoists of the same capacity, this Yale & Towne Mfg. Co. hoist enables one man to lift 1000 lb three feet in 20 seconds. High strength aluminum castings and alloy steel plus fewer parts make possible a featherweight unit without sacrifice of strength or headroom. High speed operation is due to minimized friction. All rotary shafts have ball bearings, and parts are precision machined. Load brake provides split-second automatic braking when hoisting or lowering. Balanced and cushioned springs force engagement of a six tooth pawl and a 24-tooth ratchet assuring positive, immediate braking action.

(Continued on page 10)

Prevent Return Line Corrosion

with

FILMING AMINES

HERE'S AN exciting *new* development in the Water Conditioning Field!

Corrosion of steam and condensate return lines is a serious problem to most industrial plants. Such corrosion is caused by the presence of carbon dioxide and oxygen. Up to now, it has been the usual practice to neutralize the carbon dioxide. However, the high cost of this neutralization method has limited its application. And, no protection against oxygen corrosion is assured.

Betz Laboratories have developed a new, advanced process for the prevention of return line corrosion employing *octadecylamine*. This material *does not* neutralize the carbon dioxide. Instead, the amine is adsorbed on the metal surfaces in a monomolecular non-wettable film which acts as a barrier between the metal and the condensate, protecting against both oxygen and carbon dioxide attack. The monomolecular film does not increase in thickness with continued treatment. Results? As high as *99 percent reduction* in corrosion rate has been achieved!

Let a Betz Field Engineer show how you can cut costs in your plant with the use of filming amines. Write today! There's no obligation, of course. W. H. & L. D. BETZ, Gillingham & Worth Sts., Philadelphia 24, Pa. In Canada: BETZ Laboratories, Limited, Montreal 1.

Send for Betz Technical Paper # 121, "How Filming Amines Prevent Steam and Return Line Corrosion".

*U. S. PATENT 2,460,259

BETZ

BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT

(Continued from page 8)

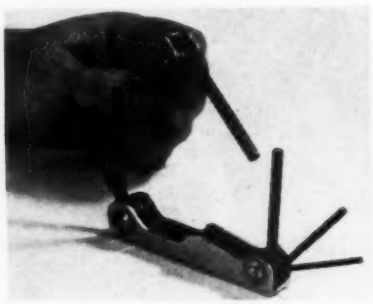
306—CAST BUCKET IMPROVES EFFICIENCY

Cast integrally with a single link of chain, Beaumont Birch Company's buckets cannot loosen and fall off. They are easy to replace —costing no more than a bucket with single link of chain. There are no raised surfaces or

projecting bolt heads on inside of bucket to retard discharge of material. Made of a heat-treated alloy steel, the bucket is exceptionally durable. The front edge and corners are reinforced to withstand severe abrasive action while loading. The bottom of the bucket is flat to prevent arching. Made in five sizes, 8 x 5 in., 10 x 6 in., 12 x 7 in., 14 x 7 in. and 16 x 8 in. Other sizes can be furnished to meet requirements.

307—WRENCH HAS KNIFE-LIKE FEATURE

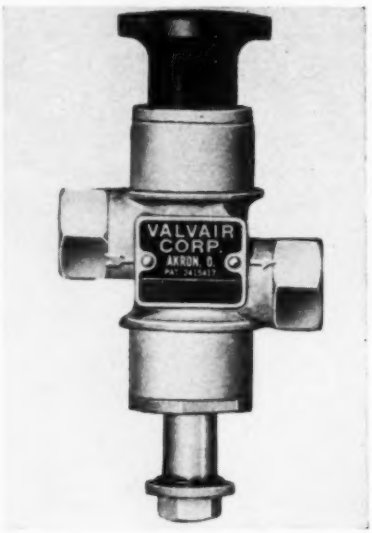
The H. D. Hunter Co. has developed a hand tool with five of the most popular, standard-size, socket-head wrenches that fold knifelike into a single handle. It is



small enough to fit conveniently into a pocket, yet its unique design permits greater leverage than ordinary wrenches now in use and gives easy access to even the most difficult places. The individual wrenches are made of high quality, tempered steel to assure longer life and can be ground down when the end becomes worn. When it is no longer possible to grind the individual wrenches they can be easily and quickly replaced by removing the end bolt and inserting a new wrench of the same size.

309—DIECAST VALVE CAN OPERATE AT 175 PSI

Valvair Corp. now has in production an air control valve with a die-cast body that is shock-resisting, high tensile zinc alloy.

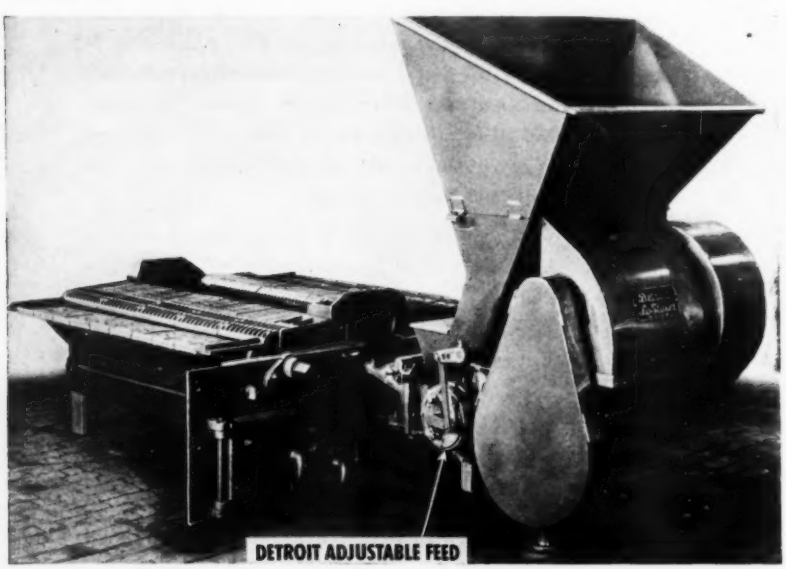


Models available with die-cast body are knob-operated and have two way and three way flow. Adaptable for air, water or oil service, they withstand pressures up to 175 psi and temperatures up to 125 F. Available in two pipe sizes: ¼ and ⅜ in.

For more information use one of the convenient reply cards on page 101. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

308—FUEL AND AIR PROPORTIONING UNIT FOR STOKER FEED

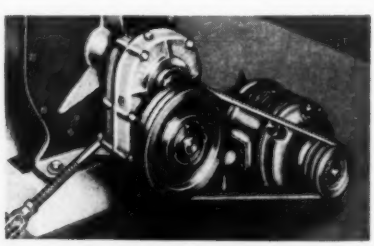
Detroit Stoker Co. has developed an adjustable coal feed control for single retort type stokers that has the advantages of proportioning air and fuel supply according to changing load conditions. The control is mounted on the side of the stoker and operates in conjunction with a variable inlet vane blower damper to proportion quantities. Operation can be either manual or automatic, with hand adjustment to permit coal feed during emergencies or for rapid warm up periods. Fuel is distributed evenly and properly agitated over the entire grate as the ram or plunger is always on full stroke.



DETROIT ADJUSTABLE FEED

310—LINE SHAFT REDUCER HAS 115 TO 330 RPM RANGE

A torque-arm reducer for output speeds from 115 to 330 rpm is now manufactured by Dodge Mfg. Corp. Claimed to be the first and only shaft-mounted reducer de-



signed for this speed range, the new single reduction unit is being produced in four sizes that cover capacities up to 27 hp. Ease and economy of installation are attributed to shaft mounting, which eliminates special engineering, foundation cost, flexible couplings, sliding base, and the time consuming operation of lining up. The compact unit is locked securely to the shaft-to-be-driven by means of two steel locking collars—one

(Continued on page 12)

How to INCREASE BOILER RATINGS with your present furnace and stack

Coppus-Dennis FANMIX Burners Give You More Heat with No Other Major Change in Equipment

Coppus-Dennis FANMIX Burners give you *perfect* mechanical mixing of fuel and air *at the burner outlet . . . instantaneous* ignition close to the burner . . . and *complete* combustion *without visible flame* when burning natural gas. No other burner combines these three advantages.

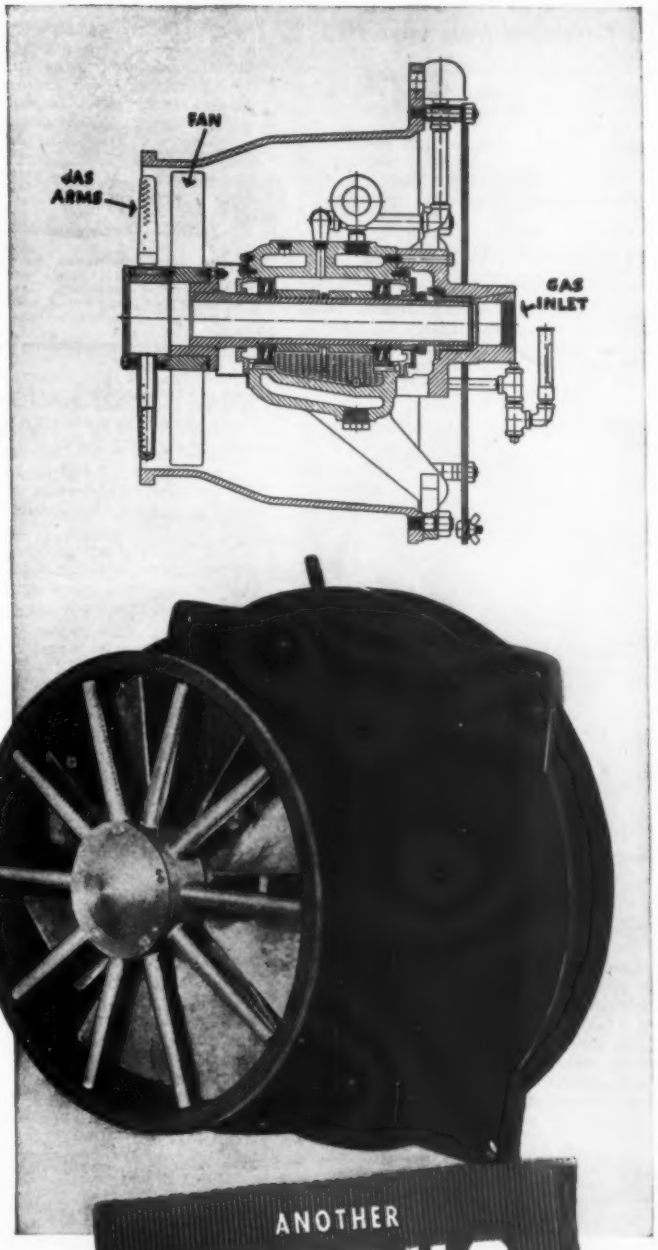
Because FANMIX delivers the *right* mixture of fuel and air *without blow-torch action*, all of your furnace space is used for combustion . . . *none for mixing*. That's why your present furnace can release more heat . . . why new installations can get more heat out of smaller furnace space.

Because FANMIX can be guaranteed to secure complete combustion of natural gas *with less than 5% excess air*, you get uniform "radiant heat" *without drifting hot spots*. That's why a FANMIX-fired furnace seldom varies in temperature more than 5% over its entire area.

WRITE FOR ALL THE FACTS

When you see in Bulletin **410-6** how fuel escaping from orifices in rotating driver arms rotates the fan to draw the correct proportion of air into the path of the fuel at right angles . . . how FANMIX creates its own forced draft, reduces stack requirements, prevents cracking of "wet" gas . . . how two FANMIX types handle either gas or oil or any combination of both — you'll understand why FANMIX Burners have such wide acceptance in oil refineries and power plants.

Send for the Coppus-Dennis FANMIX Bulletin **410-6**. Coppus Engineering Corporation, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG, and REFINERY CATALOG.



ANOTHER
COPPUS
"BLUE RIBBON" PRODUCT

COPPUS ENGINEERING CORP.
192 Park Ave., Worcester 2, Mass.
Please send Bulletin 410-6 to:

Name .....

Company .....

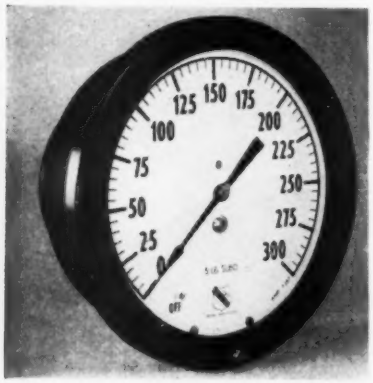
Address .....

(Continued from page 10)

on each side of the reducer. It is anchored to the floor or any other fixed object by the torque-arm. While this new reducer can be driven through any V-belt drive, the designers recommend their stock sheaves for facility either of installation or removal and for maximum efficiency of operation. Flat belt drive can also be used.

311—TEMPERATURE DEVICE THERMOCOUPLE ACTUATED

Introduction of thermocouple actuated Microsen temperature indicator and recorder line has been made by Manning, Maxwell & Moore, Inc. These devices are designed to fill the need for an economical type of electrical instrument capable of measuring temperature between minus 100 and plus 3000 F. The power actuation and construction simplicity of these instruments supplant the delicate and fragile construction of millivolt pyrometers and eliminate the need for slidewires, standard cells, delicate moving contacts or complicated mechanisms found in the more costly types of potentiometers.



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312—HEAT EXCHANGER HAS MANY APPLICATIONS

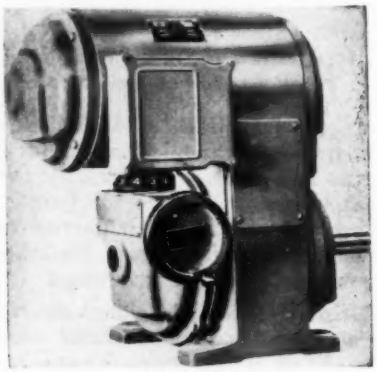
Young Radiator Co. has designed a shell and tube bundle heat exchanger for oil cooling in diesel locomotives, diesel engines, gasoline engines, and similar applications. They are standardized in manufacture for prompt delivery and minimum cost. They are said to be engineered to provide high cooling capacity within a light-weight, compact shell. These units are well suited for use with engine jacket water as the coolant, maintaining a balanced temperature between oil and water when required. The bonnets provide smooth inlet and outlet flow with a minimum impact on headers and are removable for ease in cleaning. Tubes are secured into the headers to prevent leakage from vibration and temperature changes.

313—ROOF DECK TILE RESISTS FIRE

Roof decks now can be constructed with fire protection, structural strength and insulation made of hydrous calcium silicate by the Kaylo Div. of Owens-Illinois Glass Co. These roof tiles are nominally 2⅝ x 18 x 36 in. and are white in appearance with the characteristic of high light reflectivity. This non-combustible material, predominantly composed of calcium silicate into which mineral fibers have been incorporated for reinforcing, is additionally strengthened by a welded wire mesh. It can be laid on light steel sub-purlins, wood joists or other standard structural members. Roof decks of this material weigh approximately six lb per sq ft including supporting sub-purlins, and they are easier to install than conventional decks, which are considerably heavier.

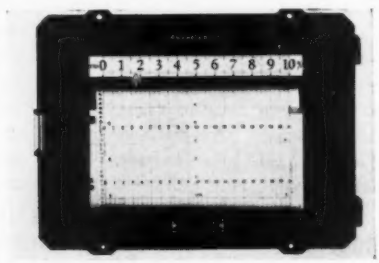
314—POWER DRIVE HAS CAPACITOR TYPE MOTOR

Sterling Electric Motors, Inc. announce that their Speed-Trol electric power drives are now available in the single phase capacitor type design in ratings of from ½ to 3 hp inclusive. They provide infinite speed variation in practically any given range that might be desired; either 2:1, 3:1 or 4:1 speed variations through a range of 2,000 to 52 rpm. This design includes such items as fingertip speed control, one piece cast iron drip-proof frame, Vinolacetal insulated wire stator windings, standard NEMA mounting dimensions and a newly designed starting relay that eliminates the necessity of centrifugal switches or any rotating devices such as throw out switches or brushes.



315—STRETCH METER RECORDS SPEED RATIO CHANGES

Percentage stretch or shrinkage of materials being processed through rolls turning at different speeds is indicated and automatically recorded by a recording speed-ratio tachometer, offered by the Tagliabue Instruments Div. of Weston Electrical Instrument Corp. Continuous record of roll speed ratio for textile, paper, plastics, rubber, chemical and metal-rolling industries is provided. Operated by two Weston tachometer generators driven by respective rolls, the instrument consists essentially of a specially developed Celectray ratio recorder. The ratio meter and



(Continued on page 14)

JOHN ZINK

—ONE JZ STOP—
BURNER SERVICE

THERE'S A JOHN ZINK BURNER FOR EVERY HEATING and POWER NEED

John Zink and his engineers manufacture more than FIFTY TYPES of gas burners, oil burners and combination burners for domestic boilers, heating boilers, industrial boilers and power boilers. The designs are protected by TWENTY United States Letters of Patent.

●

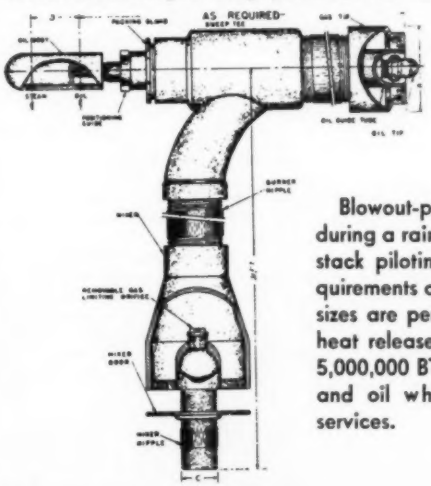
Bi-Mix Short Flame Burners for Floor and Wall Firing, Combination Gas and Oil Burners, Low Pressure Multi-Jet Bi-Air Burners, Low Pressure Heating Burners, Domestic Burners, Acid Sludge Burners, Round Flame Steam Atomizing Oil Burners, STRAIGHTENING VANES—Tubular Type, Cast Iron Wing Type, Depot Stove Burners, Unit Heaters, Air Heaters, JOHN ZINK FLOOR FURNACES.

The NEW John Zink VCBM 2-0

Combination OIL & GAS BURNER

This new John Zink burner combines all the features of the CBM and VBM combination oil and gas burners.

- Will permit the release of more heat units per cubic foot of furnace volume.
- They are the first really satisfactory combination gas and oil burners for vertical firing.
- They permit perfectly even distribution of heat in the furnace.
- Any gaseous fuel at pressures in excess of five pounds may be burned perfectly satisfactory.
- Any commercial fuel oil may be burned when properly prepared.
- Extreme simplicity of design and ease of control prevent operational difficulty.
- High sulphur content gases may be burned without port stoppage.
- Will give maximum duty with a minimum of furnace draft.
- Full rating may be taken with completely satisfactory fires with either fuel.
- Both fuels may be fired in combination when required.
- A new tile and register design permits operation at low excess air.



SERIES ST GAS BURNER

Combination Type

Blowout-proof in 80 m.p.h. wind during a rainstorm. Designed for flare stack piloting or for "spot" heat requirements of process service. Smaller sizes are perfect as pilots for burners, heat releases from 5,000 BTU/Hr. to 5,000,000 BTU/Hr. Combination gas and oil where required for some services.

— WRITE FOR LITERATURE —

JOHN ZINK COMPANY

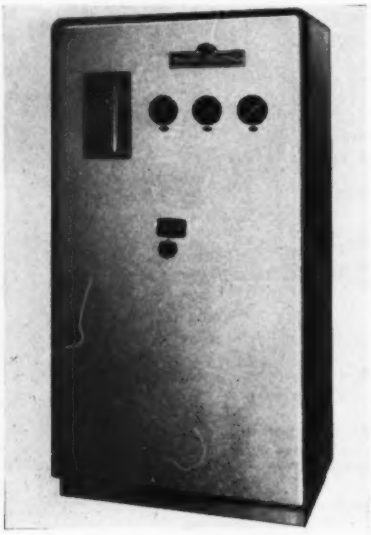
4401 South Peoria **Tulsa 1, Oklahoma**

(Continued from page 12)

recorder can be calibrated in per cent stretch as in yarn processing, inches per yard shrinkage as in fabric Sanforizing, percentage reduction as in metal rolling, or other units which are a function of the speed ratio between two rotating members. Various calibration ranges are available.

316—CHLORINIZER HAS VISIBLE FLOW FEATURE

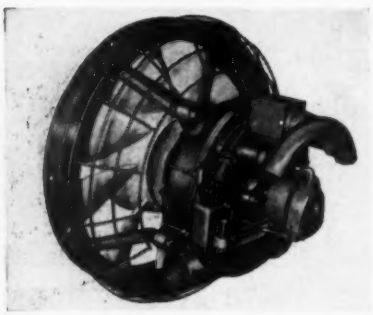
Builders-Providence, Inc. has introduced a high capacity chlorinizer that has a visible gas flow feature and automatic control to provide chlorine to three points of applica-



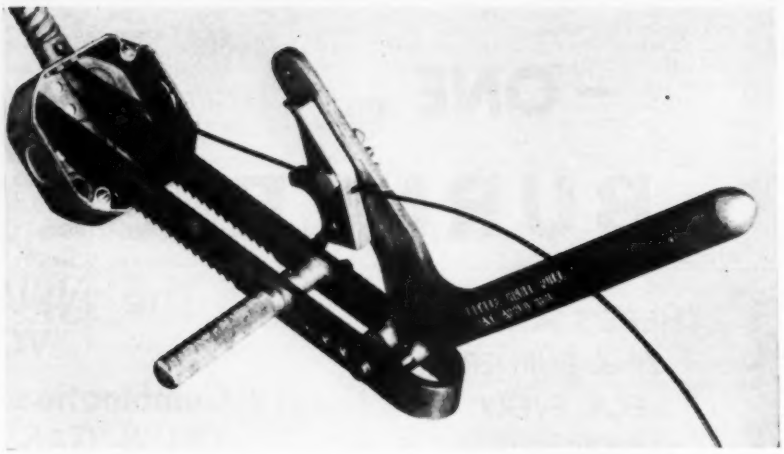
tion. Proper feed rate is provided to meet chlorine demand at three individual points and also will select the sequence of point of application. This unit insures the dosage at any point of application will be properly controlled and metered for any pre-determined period and setting. This chlorinizer is a simplified apparatus for metering and controlling chlorine gas feed by manual, or semi automatic means.

317—TURBINE BLOWERS FOR 600 PSI & 750 TT STEAM

L. J. Wing Mfg. Co. now has a line of turbine blowers with all-steel turbines, suitable for steam conditions up to 600 psig and 750 F TT. These blowers have been modernized for high efficiency and quiet operation with fan impellers of true airfoil



design and streamlined air entry. No water cooling required since bearings and lubrication system are automatically air cooled| For oil burner applications they can be bolted directly to the front windbox without additional supports. Also furnished for vertical down discharge or for cementing into boiler brick work. They are ideal for capacity regulation through speed variation. Capacities to 70,000 cfm or statics to 20 in. water.



318—FISHTAPE PULLER FEATURES EASE OF OPERATION

Fishtape puller, which combines the conventional hand puller with a detachable pressurized puller for more difficult jobs is now available from Mallasch-Brandt Engineering Co. The "Little Giant" pulls from top sides and bottom and is readily adjusted to pull at any angle with any desired length of stroke. The controlled, automatic gripping and releasing action during operation completely eliminates kinking or snapping-out of fishtape. Sawtooth-designed holding edges fit all standard outlet boxes, gutters and switches up to 8 in. Made with a reversible hand grip to provide either left- or right-hand operation. Constructed to withstand wear and hard usage, this efficient tool will prove indispensable to electricians, telephone, power and gas service men.

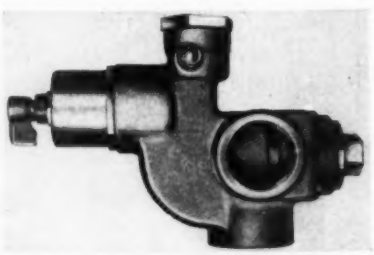
319—COAL SCALE HAS AIRTIGHT CONSTRUCTION

The Richardson Scale Company's "K-29" automatic coal scale incorporates several exclusive features. Most important is its ability to remain pressure-tight under back pressures up to 60 in. of water. This pressure-proof feature contributes to combustion efficiency by preventing loss of primary air through the coal scale, aids in maintaining a clean boiler room and assures consistently accurate scale performance even under high back pressures. Available with hopper for capacities of 400 or 500 lb. Maximum hourly coal capacities are 30 to 40 ton. Inlet opening of the scale has been especially designed to keep coal from hanging up. Its 20 x 20 in. inside dimensions guarantee a positive flow of coal. A flapper seal retains fines and assures a clean discharge for each weighing.

For more information use one of the convenient reply cards on page 101. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

320—MIXING VALVE HAS LARGE CAPACITY

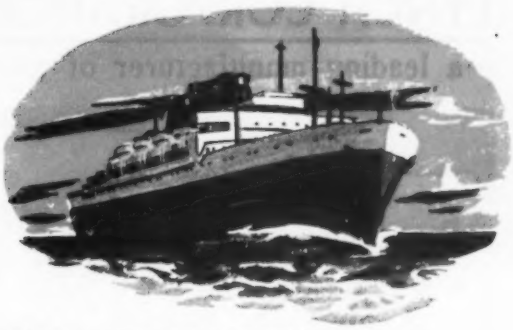
Automatic hot water mixing valve has large capacity and gives the exact hot water temperature required wherever it is wanted.



The unit manufactured by Symmons Engineering Co. is operated by a thermostatic solid fill bellows mounted out of the water in a protected chamber subject only to atmosphere. To this thermal element is attached

(Continued on page 16)

1. Before pulp becomes paper, long, trim lines of copper tube have conveyed pulp, stocks, "white water" and just plain water.



2. Engine rooms of great steamships are a maze of copper tubes carrying steam, hot water, cold water, sea water, fuel oil, and lubricating oil.

3. Copper tubes, more than any other kind of piping, form the "production lines" of the chemical and pharmaceutical industries.

4. At the brewery, beer leads a sheltered life in immaculate copper equipment. Both wort and beer flow with impunity through copper tube lines.

Where rust won't do . . .

COPPER will!

WHETHER you write a letter, read a book, drink a glass of beer, raid your icebox, turn on your oil burner, ride in a motor boat or an ocean liner, copper tubes are serving you. And when you take a pill, chances are that copper tubes helped to make it . . . and to fill your glass with water, too!

All-in-all, millions of feet of copper tubes, of many sizes and types, are at your service right this minute . . . and more of it carries the Anaconda name than any other.

Anaconda Copper Tubes

ANACONDA **THE AMERICAN BRASS COMPANY**

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont*

LYNCH CORPORATION of Toledo, Ohio,

—a leading manufacturer of packaging machinery

The following quotation is taken from a letter we received from their Director of Sales:

"The majority of our machines are used in places where it is necessary to wash them with steam and hot water after each day's use. This naturally would remove any ordinary lubricant and trouble would develop if the machines were not immediately relubricated. With LUBRIPLATE it is different. There is always a film of LUBRIPLATE left on the machine after washing. This gives protection not only to moving parts, but also prevents general corrosion. The presence of salt and lactic acid in packing plants makes oxidation a hazard. LUBRIPLATE prevents this too.

"LUBRIPLATE greatly reduces unnecessary wear and prolongs the life of machines. It has reduced customer calls for service to a minimum. Our Service Engineers can readily spot machines that have had other than LUBRIPLATE Lubrication, as these machines do not give the service they should.

"After using LUBRIPLATE for over ten years, we are very well pleased with it and enthusiastically recommend it."

A LUBRICANT must be more than good to warrant such a recommendation. The Lynch Corporation, as well as hundreds of others who build machines to sell, not only use LUBRIPLATE Lubricants in their own shops, but also advise the buyers of the machines to always use LUBRIPLATE for re-lubrication.

LUBRIPLATE Lubricants are different from all other lubricants. They have properties all their own . . . they reduce friction and wear, prevent rust and corrosion and save power. They stay put under most adverse conditions and do not run out or wash away.

There is a LUBRIPLATE Lubricant that is just the right density for your requirements. Let us tell you about it. *Write today.*

LUBRIPLATE DIVISION
Fiske Brothers Refining Company
Newark 5, N. J. Toledo 5, Ohio

DEALERS EVERYWHERE—CONSULT YOUR CLASSIFIED TELEPHONE BOOK

LUBRIPLATE

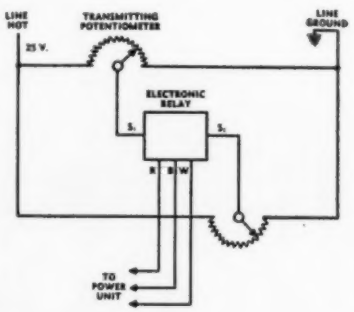
THE MODERN LUBRICANT

(Continued from page 14)

72 running in. of liquid filled copper tubing, which is located in the mixing chamber. Temperature changes in the mixing chamber produce hydraulic action to the external thermal element that actuates the valve. This valve furnishes reliable and accurate control and is designed to act as a master control or a zone controller that may be placed anywhere along the line as desired.

321—ELECTRONIC DEVICE POLARIZES RELAY

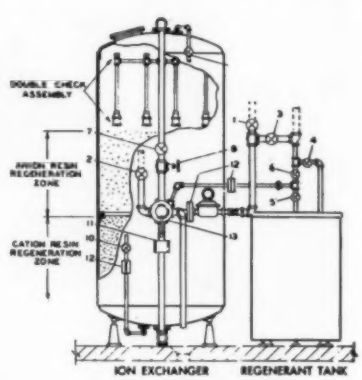
The Barber-Colman Company's electronic polarized relay has been designed for use in self balancing a-c bridge circuits. It provides a link between a controlling device such as a



slide wire controller, manual rheostat, temperature and humidity sensitive resistance elements and the controlled device equipped with a balancing potentiometer. A change in control condition will unbalance the bridge and the relay will cause a control motor or valve operator with integral balancing potentiometer to move an amount proportional to that change in order to rebalance the bridge.

322—SINGLE TANK DEIONIZER GIVES MINERAL FREE WATER

One of the most recent developments in the field of water conditioning is a single tank deionizer, a product of Elgin Softener Corp., that offers water of higher quality.



In addition to producing high quality, mineral-free water, this deionizer will also completely remove silica and CO_2 from water —an essential requisite for steam generation—especially for boilers of high pressure

(Continued on page 18)

Dust Control System on Rotary Breaker Screen and sand handling system in a casting plant of one of the nation's largest steel companies.

The large volumes of dust produced in the sand handling operations of this plant are not a problem. As soon as dust is formed, it is removed by the KIRK & BLUM Dust Control System.

One of the many KIRK & BLUM foundry installations, this Dust Control System meets every requirement of the American Foundrymen's Association code; heavy gauge piping has flanged joints and convenient clean-out doors.

Hundreds of plants, large and small, have found it pays in *greater operating efficiency* to have a dust or fume control system designed and installed by experts. For all three—design, fabrication and installation—call on KIRK & BLUM.

If you need a new dust control system . . . or more capacity in an existing one, contact KIRK & BLUM. They'll gladly prove the money-saving efficiency of systems by KIRK & BLUM, specialists in dust and fume control for more than 43 years. For Booklet, write The Kirk & Blum Mfg. Co., 2874 Spring Grove Ave., Cincinnati 25, Ohio.

One Undivided Responsibility
DESIGN...FABRICATION...INSTALLATION
For all three—call on K&B

FOR CLEAN AIR... THE INVISIBLE TOOL

KIRK AND BLUM

DUST CONTROL SYSTEMS

(Continued from page 16)

type. The degree to which mineral impurities have been removed from water is to test its electrical resistance. Good quality distilled water has about 50,000 to 500,000 ohms specific resistance. Specific resistance of water delivered by this deionizer is said to be above 5,000,000 ohms. An important feature of this equipment is the manifold arrangement, which guards against loss of zeolite during the backwashing operation and permits the use of deeper zeolite beds for increased capacity. Two types of resinous zeolite exchangers are used in the deionizer; one for the positively charged ions (cations) and one for the negatively charged ions (anions). The cation exchanger is regenerated by a dilute acid solution; anion exchanger by caustic solution.

For more information use one of the convenient reply cards on page 101. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

323—MASONRY SAW COMES IN FOUR MODELS

Plants can now cut concrete or asphalt floors for expansion joints or patchwork for repairs. Straight, smooth cuts are made with amazing speed and provide finished edges for pouring concrete. These portable saws are the latest development of Clipper Manufacturing Co. whose engineers have had experience in cutting every form of masonry material. Two gasoline powered units are available, model C-75 with 7½ hp engine, or C-130 with a 13 hp 2-cylinder engine.

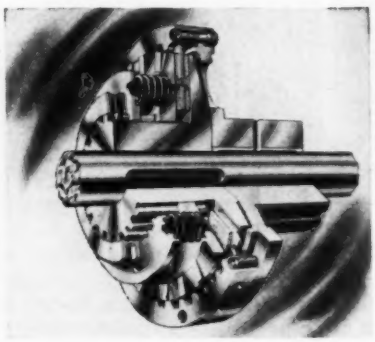
Models C-15 and C-20 are equipped with electric motors. Outstanding features claimed are: floating three point suspension which eliminates blade binding as saw is moved over rough surface, positive screw feed, and streamlined design for ease of handling.

324—SLIP CLUTCH HAS 10,000 FT-LB CAPACITY

A slip clutch has been designed by the Hilliard Corp. to help solve the problem of maintaining constant tension or constant torque on winding operations. It has wide application for industrial winding uses such as the printing, paper making, plastic, wire and textile industries. Designed as a safety device for overload protection or to maintain constant torque regardless of driving speed. Special features include ventilated plates,

325—PLASTIC SLIDE RULE FOR ELECTRICAL COMPUTATIONS

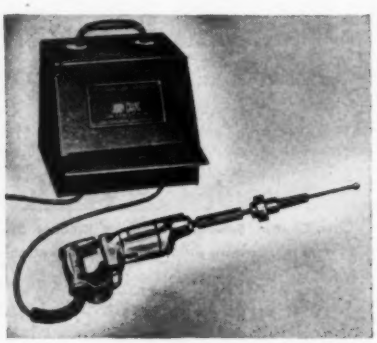
Slide rule, made of Vinylite plastic for I-T-E Circuit Breaker Co., provides a quick and accurate way of computing the interrupting capacity required in low voltage a-c systems for the proper application of electrical circuit breakers. Dimensional stability of this material under widely varying conditions permits calculations correct within two per cent. Lettering, numbers and scales are printed with special inks, which adhere firmly to the polished surfaces.



cooling fins and pressure springs with long deflection range for accurate adjustment. Single, double and triple plate construction is available. When the function is constant tension, the regular adjusting nut is replaced with a sliding collar to permit adjustment while the unit is in operation. Offered in sizes from 2⅜ to 27 in. dia with torque range up to 10,000 ft lb and heat capacity up to 8½ hp.

326—CONTROLLER ASSURES TUBE UNIFORMITY

A simplified, low-cost control for rolling ferrous and non-ferrous tubing is offered by the Crane Packing Co. This precision tool eliminates over-expanding and under-expanding of tube ends, tube end thinning, and radial and hoop stresses in tube sheet. Only

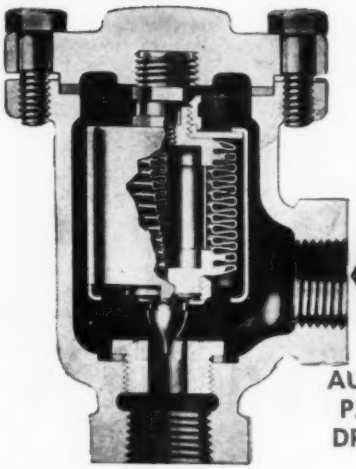


two electrical working parts, no electronic tubes, and alignment is automatic.

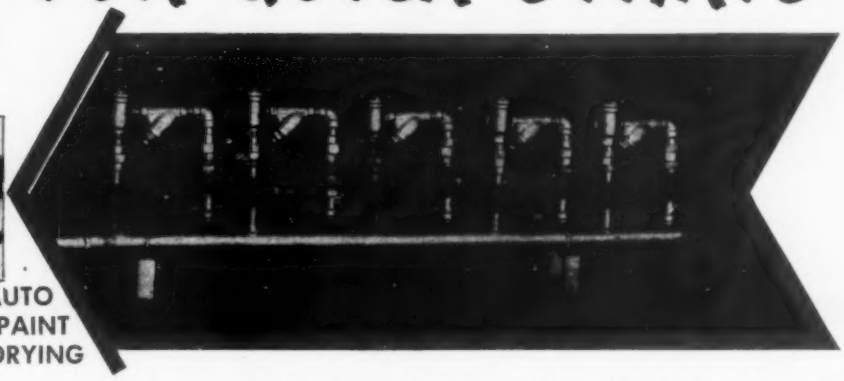
327—HEXAGON SOCKETS HAVE THIN WALLS

Addition of twenty single-hexagon thin-wall socket wrenches to the PROTO line has been announced by Plomb Tool Co. that can be used in restricted areas—wherever corresponding double-hexagon types will fit. Although thinner than regular power sockets, the new designs are guaranteed for power or hand use in service work. Single hexagon sockets are particularly useful because they safely fit and turn undersize nuts, as well as those that are rusted or damaged. They permit safe work on stubborn nuts without dan-

(Continued on page 118)



FOR QUICK STARTS



SARCO No. 9 THERMOSTATIC STEAM TRAP

. . . AND STEAM ECONOMY

The hours of waiting in the morning for steam equipment to warm up can be reduced to minutes with the Sarco No. 9 thermostatic steam trap. It is wide open when cold. All air and condensate pass quickly. Then, during normal operation, condensate is discharged at a temperature within 10°F of that of the steam. This has given the trap double its former capacity. No seat changes are required for varying pressures within the range of each type from 0 to 300 p.s.i.

END GLUING

BOTTLE WASHING

PUT ONE ON EACH COIL

This trap is so inexpensive that one can be placed on each coil or jacket and thus save enough in fuel and increased production to pay for the hook-up in a short time. The Sarco No. 9 is used extensively for process tanks, steam lines, radiators and wall coils, tracer lines and outdoor applications of all kinds. Ask for Catalog No. 250-A.

314

SARCO SAVES STEAM

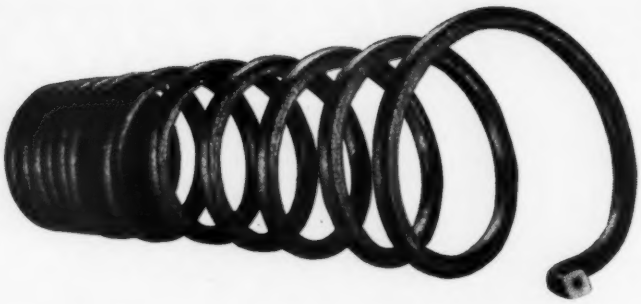
SARCO COMPANY, INC.

Represented in Principal Cities

Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

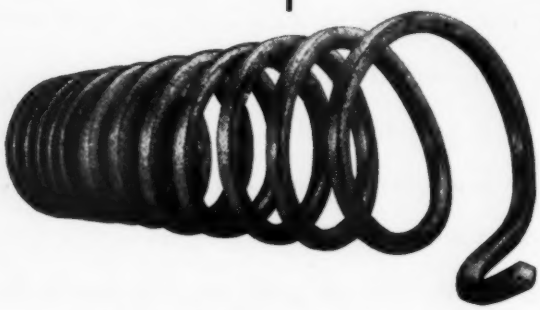
IMPROVES PRODUCT QUALITY AND OUTPUT



R/M No. 121

R/M No. 122

2 high-pressure packings especially built for tough jobs



Raybestos-Manhattan manufactures a variety of packings especially designed for compressors, steam pumps, steam valves, expansion joints and other high-pressure equipment.

R/M No. 121 is constructed of asbestos cloth over a resilient core of asbestos and rubber. It is commonly used on steam engines, compressors and pumps. It is also available in a solid form (No. 124).

R/M No. 122 is made of a resilient rubber core covered with bias-cut asbestos cloth lubricated and graphited. It is recommended for reciprocating steam or air rods and valve stems. For extra-heavy service, this packing can be furnished reinforced with wire-inserted cloth.

For full information on R/M packings for high pressure equipment, see the authorized R/M packing distributor near you, or send in the coupon below.

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn. Manheim, Pa. No. Charleston, S.C. Passaic, N.J.

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Asbestos Textiles • Mechanical Rubber Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts Radiator Hose • Powdered Metal Products • Bowling Balls

RAYBESTOS-MANHATTAN, INC. IP—120
Packing Division, Manheim, Pa.

Gentlemen: Please send me data on R/M high-pressure packings.

Name_____

Position_____

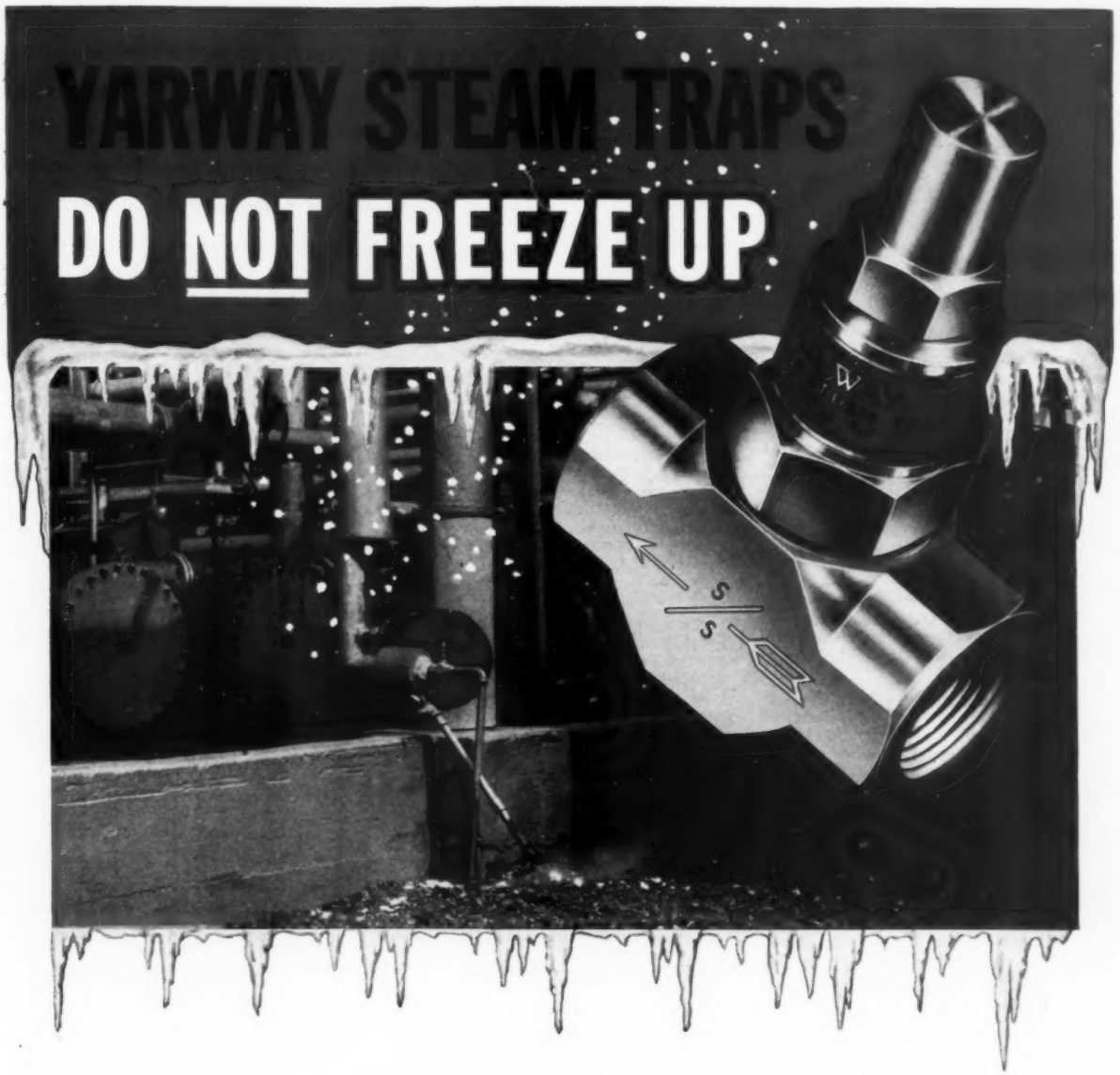
Company_____

Address_____

City_____ Zone_____ State_____

R/M

YARWAY STEAM TRAPS DO NOT FREEZE UP



What if it is freezing cold—your exposed steam traps won't cause you any worry if they're Yarway.

Yarway Impulse Steam Traps don't freeze because condensate does not accumulate. The only moving part—a little valve—is continually testing for condensate and passing it as soon as it forms. It never waits for a trapful to collect. Hence, there's never anything to freeze.

There are other good reasons, too, why more than 650,000 Yarways have been bought for both indoor and outdoor installations.

They get equipment *hotter, sooner.* They are *small in size, light in weight, easy to install and maintain.* They are *good for all pressures.* Construction is *stainless steel.*

Prove these advantages in your own plant at our expense. Try a Yarway *for free.* Call your nearby Yarway distributor or write direct to . . .

YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

Stainless Steel Body
YARWAY IMPULSE STEAM TRAP

I & P review of literature

Reviewed for your convenience is pump literature selected from past issues of INDUSTRY AND POWER. These bulletins will help you solve pump problems introduced by the re-armament program. List key letters on postage-free card, page 101

Centrifugal Pumps (PA) Three folders are offered that contain information on: long coupled, close coupled, and straight centrifugal pumps. Dimensions and engineering data are included for all sizes in each type of pump. The proper selection can be made for any situation. Marlow Pumps.

Centrifugal Self-Primers (PB) Brochure of eight pamphlets covers detailed information on a line of self-priming centrifugal pumps, that are portable and are mounted on chassis. Features and specifications are listed for each pump and companion engine. Leyman Mfg. Corp. McGowan Pump Div.

Self-Priming Pumps (PC) Catalog on self-priming centrifugal pumps covers specifications, operating characteristics, and engineering data for proper selection. Numerous photographs and illustrations are shown of basic principles and features. Marlow Pumps.

Sludge Pumps (PD) Pamphlet explains how this pump has been engineered to handle sludge problems. A cutaway of the pump is shown, and captions—with leader lines to the important parts of the unit—give a clear picture of the operating principles and features. Marlow Pumps.

Self-priming Pump (PE) Unique construction details of this self-priming, centrifugal pump are explained in a four-page multicolor bulletin. Cutaway view, captioned with leads to the important parts, gives a clear picture of all working parts. Dimensional chart is listed for 3500 rpm, 1½ to 10 hp sizes. Allis-Chalmers Mfg. Co.

Positive Volume Pumps (PF) Rotary and centrifugal positive blowers and exhausters in single and multiple stages are illustrated and thoroughly discussed in a four page bulletin. Features of each pump are explained, and typical applications are suggested. Roots-Connersville Blower Corp.

Centrifugal Pumps (PG) Four-page flier describes a line of cradle-mounted centrifugal pumps. A sectional view of the pump is shown with all of its salient features pointed out and described. In addition, the various types of drives are illustrated. Ingersoll-Rand Co.

Two Stage Pump (PH) Features of three, two stage, double suction centrifugal pumps are illustrated and described in detail. Dimensional data and selection chart are included. These pumps operate at 400 to 1,300 ft head. Worthington Pump and Machinery Corp.

Air Powered Pumps (PI) Pictorial 16-page bulletin covers all applications of an air-operated, controlled volume pump. Design details and advantages are illustrated and explained. Flow diagrams, utilizing this pump, are shown for several types of installation. Milton Roy Co.

Vertical Centrifugal Pump (PJ) Colorful bulletin covers all phases pertinent to installation, maintenance and construction features of an encased vertical centrifugal pump. Characteristics such as capacities, heads, drives and construction materials are analyzed. Dimension and selection data are listed. Peerless Pump Div., Food Machinery and Chemical Corp.

Centrifugal Pumps (PK). New engineering approach is described in 3-page bulletin on vertical, double-case pumps for capacities up to 450 gpm (increased by manifolding), pressures to 5,000 psi and temperatures to 900 F. Advantages and applications are given. United Centrifugal Pumps, Div. of United Iron Works.

Rotary Pumps (PL) Bulletin (8 pages) titled "Facts" illustrates design, construction, maintenance, operation and application of rotary pumps. Details of sliding and swinging vane types with selection table for specifying and other data of interest to engineers, maintenance men and plant operators included. Blackmer Pump Co.

Centrifugal Pumps (PP), Single and two stage, size 1 to 5 centrifugal pumps designed for small boiler feed, cooling service, condensate service and many other uses are described in informative bulletin. Specifications, motor data, rating curves and construction materials are included as well as 11-page section entitled "How To Select A Cold Water Pump". Worthington Pump and Machinery Corp.

Vertical Turbine Pumps (PN). Graphically portraying construction details and various types of drives by the use of large color illustrations, this 20-page bulletin also discusses the wide variety of applications possible with deep-well turbine pumps. Can be furnished for 4-in. or larger wells. Capacities range from 12 to 3,000 gpm. The Deming Co.

Service Pumps (PO) Titled "Short Coupled Service Pumps", 16-page bulletin contains cutaway drawings of pump bowls and discharge column. Sketches show the vertical turbine pump applied to river and re-lift service, boosting, recirculation, cooling tower, drainage, gas and oil pumping, and fire pumps. Layne & Bowler, Inc.

Vacuum Pumps (PM) Cycloidal pumps, capable of producing vacuums of from 4 to 26 in. Hg in large capacities are described in 12-page bulletin. Application illustrations, cross-sections of pumps, installation diagrams and operating curves are included. Roots-Connersville Blower Corp.

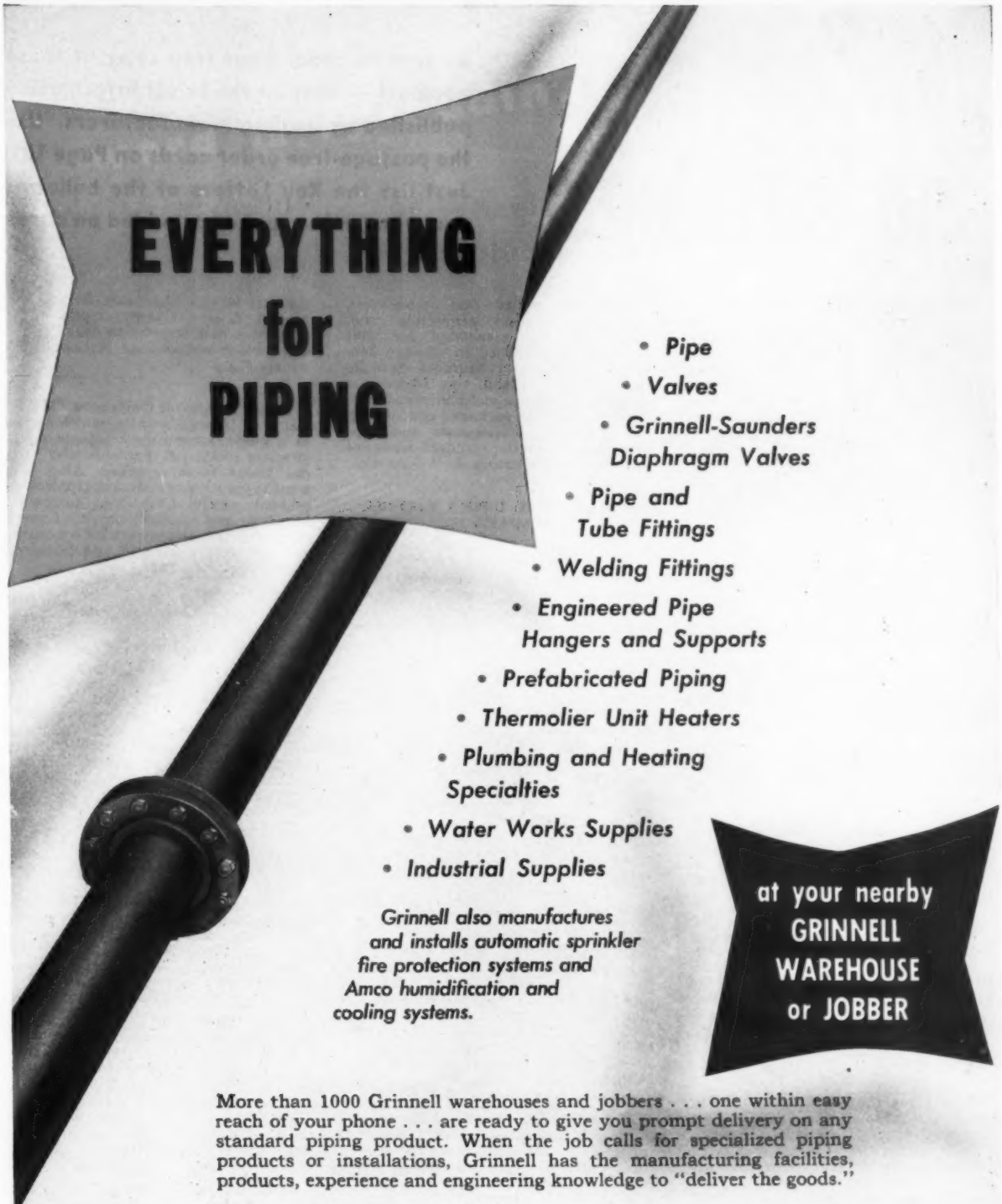
Rotary Pump (PQ). New general service, screw-type rotary pump, with capacities to 85 gpm and pressures to 150 psi, is described and illustrated in 8-page bulletin. Contains cross-sectional drawing, viscosity tables, dimension drawings and table of the standard NEMA motor frame sizes. IMO-DeLaval Products Div. DeLaval Steam Turbine Co.

Self-Priming Pump (PS). Complete information on new self-priming centrifugal pumps now available in 8-page bulletin. Sizes from ¼ to 5 hp, with capacities to 120 gpm and heads to 135 ft. Also given are general description, principles of operation, construction details, specifications and two pages of performance data. Goulds Pumps, Inc.

Pump-Motor Unit (PT), Design and construction features of close-coupled pump and motor are described in 6-page folder. Available with drip-proof, splash-proof, totally-enclosed, fan-cooled or explosion-proof motor enclosures, in ratings from 10 to 500 gpm at heads to 220 ft. Motors are rated to 10 hp. Allis-Chalmers Mfg. Co.

Impeller Pumps (PU). Pumps with two-vane closed impellers in various types and sizes are described in a 16-page booklet. Line drawings, general data, performance curves, fittings of standard pumps, shafting charts, sizes of motor stands required are shown. Worthington Pump & Machinery Corp.

High Pressure Pumps (PV). Recently designed 5 in. stroke multiplex direct flow pumps are described in 6-page bulletin that covers construction, specifications, and drive requirements. Included are: pump selection chart, dimension drawings, plunger, pressure and other data. The Aldrich Pump Co.



EVERYTHING for PIPING

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- Pipe and Tube Fittings
- Welding Fittings
- Engineered Pipe Hangers and Supports
- Prefabricated Piping
- Thermolier Unit Heaters
- Plumbing and Heating Specialties
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Grinnell also manufactures and installs automatic sprinkler fire protection systems and Amco humidification and cooling systems.

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More than 1000 Grinnell warehouses and jobbers . . . one within easy reach of your phone . . . are ready to give you prompt delivery on any standard piping product. When the job calls for specialized piping products or installations, Grinnell has the manufacturing facilities, products, experience and engineering knowledge to "deliver the goods."

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new bulletins and catalogs

Be sure to order your free copy of these booklets — they're the latest information published by leading manufacturers. Use the postage-free order cards on Page 101. Just list the Key Letters of the bulletins you want in the spaces provided on cards

BOILERS, AUXILIARIES, ACCESSORIES

HRT Boiler Seam Protector (A). The proverbial "stitch in time" and "ounce of prevention" seem to apply here. Circular describes refractory tile that insulates lapped edges of hrt boiler plates from fire-cracking and oxidation. Manufacturer says further calking is unnecessary, plate patching is avoided and the explosion hazard due to seam failure under pressure is averted. All pertinent data including complete installation methods are included. National Boiler Protector Co.

Oil Burners (B). Here is a burner with a built-in oil valve that may easily be moved from one furnace to another. Low-pressure air type for applications requiring a 10 to 1 turndown in firing capacity with manual and individual control of oil and air. Additional features, capacities, dimensions and other data are contained in 6-page bulletin. Hauck Mfg. Co.

Ash Handling Systems (C). This 24-page booklet answers all your questions about hydraulic and pneumatic ash and flyash handling systems. You get a discussion on the various systems and on disposal schemes. Actual schematic drawings of arrangements under specific conditions and diagrams of basic arrangements are included. Beaumont Birch Co.

Double Hung Arch (D). Arch that not only hangs, but moves like a pendulum is described in 4-page bulletin. Shows the ease of installation and the positive locking arrangement between lower and upper tiles, preventing disengagement in service. Also illustrates the rugged load tests given the arch. Geo. P. Reintjes Co.

Dual Circulation Boilers (E). Concerned about your steam purity? The ability to produce steam of super purity is only one of the advantages pointed out in a 16-page bulletin. This book explains the principles of dual circulation and describes applications for high and low make-up plants. Employs 2-color charts and drawings along with diagrammatic sketches to illustrate important points. Foster Wheeler Corp.

Auxiliaries (F). Low, medium and high pressure blow-off valves, water columns and gages, liquid level indicators and recorders, expansion joints, steam traps and other steam plant equipment are described briefly in 12-page illustrated general catalog. Yarnall-Waring Co.

Packaged Boiler (G). Compact, ready-to-use steam generating unit, completely shop-assembled for unit shipment is described in 12-page brochure. Pictures and diagrams illustrate the gas flow method, soot blower arrangement, furnace and boiler wall construction, and the packaged control cabinet. Capacities, dimensions, and shipping weights of the standard sizes are included. The Babcock & Wilcox Co.

PRIME MOVERS: DIESELS, TURBINES, COMPRESSORS

Diesel Engines (H). Three mailing folders offered by this company describe its line of diesel engines and power units. Many industrial applications are shown and specifications given. Collection of on-the-job photographs illustrates the folders. International Harvester Co.

Power Equipment (I). Products commonly used on power generating, transmission and distribution systems are briefly presented in 28-page illustrated bulletin. Included under generation are steam and hydraulic turbines, generators and such auxiliary equipment as condensers, pumps and water conditioning. Miscellaneous transmission and distribution equipment are also covered. Allis-Chalmers Mfg. Co.

WATER AND LIQUID TREATMENT

Cooling Towers (J). This 4-page bulletin lists sizes from 3 to 100 ton capacity in the packaged and prefabricated models and any capacity in large industrial cooling towers. Equipment, such as cooling tower fans, gas scrubbers, air cooled heat exchangers, packaged dehydration units, also is shown. J. F. Pritchard & Co.

Water Clarification (K). Bulletin describes an apparatus, which takes advantage of the well-known principle that previously formed precipitates added in the form of sludge or slurry will accelerate reactions. Details the principle as applied to a sludge-contact reactor, illustrates the types of equipment and auxiliaries available and gives a list of applications. Waste recovery is also covered. Cochrane Corp.

Packaged-Boiler Water Treatment (L). Don't use hit or miss methods—protect your packaged boiler with a special adaptation of the same program used in large power plants. A 4-page bulletin explains the four essential points of this water treatment system; they are service, chemicals, feeding and control. A service contract plan offers protection and security to operators of small boiler installations. National Aluminate Corp.

Water Treatment Guidebook (M). Illustrated 12-page booklet, which serves as a guide, covers the complete scope of water treatment. Explains why various water troubles occur. Also tells what types of treatment are required to prevent scale formation, corrosion, foaming and embrittlement. Covers supplementary treatments for lime-soda softened, zeolite softened, and deionized water. Elgin Softener Corp.

ELECTRICAL EQUIPMENT

Flexible Liquid-Tight Conduit (N). Complete protection of electrical wiring against moisture, seepage of liquids and deterioration due to corrosive fumes is what you get by using this flexible liquid-tight conduit. Description and simple installation data are contained in 4-page bulletin. Direct quotations from testimonial letters are listed. The American Brass Co. American Metal Hose Branch.

Dry-Type Transformers (O). Reasons why dry-type transformers are safer and less costly to install and maintain are shown in 23-page booklet. Transformers for every use up to 10,000 kva including sealed, submersible types for underground installation are illustrated and described. Westinghouse Electric Corp.

Motor-Generators (P). An unbeatable team for performance, quality and service are these G-E synchronous motor-generator sets, says an 8-page bulletin. Covers sets from 30 to 8000 kw as a source of dc power for many industrial applications. Shows four typical installations and describes construction features. General Electric Co.

Synchronous Motors (Q). Developed over a period of 27 years, these high-speed synchronous motors are available in ratings 20 hp and larger—514 rpm and up. Complete data on the expanded line of motors are given in 4-pages. The Electric Products Co.

Disconnecting Switches (R). Application information to simplify selection of air-disconnecting switches is contained in 8-page booklet. Highlights on the design and operation of five out-

(Continued on page 26)

word is spreading

about Foster Wheeler Dual Circulation Steam Generators

The first of a group of Foster Wheeler Dual Circulation Steam Generators was placed in service in May 1948 at a large midwestern refinery. It has been in successful operation ever since and has proved its ability to produce steam of much greater purity than has been hitherto attainable in a boiler of conventional circulation.

Evidence of the increasing acceptance of the Foster Wheeler Dual Circulation Steam Generator is demonstrated by recent additional orders from both the utility and refinery industries.

FOSTER WHEELER CORPORATION
165 BROADWAY, NEW YORK 6, N. Y.

Write for a copy of Bulletin B-50-11 which covers the principles and advantages of Dual Circulation.

(Continued from page 24)

door and two indoor types are given. Westinghouse Electric Corp.

Electric Motors (S). The best prelubricated bearing design in electric motors—that's what this 4-page "Inside Story" on Reliance motors contends. A page of statements by bearing manufacturers and a comparison chart, together with descriptive sketches and cutaway drawings are offered to uphold their claim. Reliance Electric & Engineering Co.

Single-Phase Repulsion Motors (T). For applications requiring relatively constant torque try these 1/6 to 3 hp continuous-duty, varying-speed motors. Bulletin illustrates types of remote speed and operating controls and contains data on current consumption at varying speeds. Star-Kimble Motor Div. of Miehle Printing Press Mfg. Co.

Electric Motor Lubrication (U). Damaged bearings may cause a costly burnout. It will pay you to read this 4-page bulletin on the Lubriflush principle. Shows comparative amounts of lubricant in different bearing designs and how bearings are subject to air circulation. Tells how bearings can be lubricated for life; also, how they can be purged of old lubricant and refilled without disturbing the bearing housing. U. S. Electrical Motors, Inc.

Remote-Control Wiring (V). Comprehensive 36-page manual on a new low-voltage system includes a picture visualization of the system's features; detailed information on where it may be used; pictures and technical explanations of all the components; circuit diagrams; specification guide; and a full discussion of installation methods for new wiring and rewiring. Construction Materials Dept., General Electric Co.

Motor Starters (W). Type H motor starters for 2300 to 5000-v squirrel cage, wound rotor, synchronous and multi-speed motors are described in 12-page bulletin. Ratings are up to 2500 hp at 5000 v. Another bulletin describes in detail the air break contactor which is particularly adaptable for applications requiring frequent starting, inching, reversing, plugging or dynamic braking. Allis-Chalmers Mfg. Co.

Lighting (X). Complete line of commercial and industrial fluorescent and germicidal lighting equipment is presented in new catalog. Covers a full range of fluorescent fixtures in a condensed, easy-to-refer-to form. The Edwin F. Guth Co.

INSTRUMENTS, CONTROLS, RECORDERS

Starters (Y). You get compactness, versatility and dependability with these small magnetic starters and contactors in sizes 0 through 4. The controls contain a right-angle balanced mechanism, "blow-out" contact design, straight-through wiring, high arc resistance, and suppression chambers in addition to other features claimed to add to performance and safety. Ratings, dimensions and other engineering and design data are given in 8-page booklet. The Arrow-Hart & Hegeman Electric Co.

Indicators & Recorders (Z). Features that contribute greatly to efficient and dependable performance of these thermocouple actuated temperature indicators and recorders are listed in 12-page bulletin. Contains photos, diagrams, tables, specifications and prices. Manning, Maxwell & Moore, Inc.

Instrument Valves (2B). Save time and money using one valve to replace the multiple set-up of valves and connections formerly used for instrument and regulator piping. Diagrams show various applications and compare old and new methods of connecting gages. Construction features, specifications, sizes and dimensions are given. Jerguson Gage & Valve Co.

Selection Chart (2C). Here is a step in the right direction. This company has issued a step-by-step chart for selecting the right industrial temperature control. Out of the wealth of instruments, valves and relays available, this question and answer tabulation refers you directly to the four, five or six instruments (with bulletin numbers) which best fit your needs. Partlow Corp.

For more information use one of the convenient reply cards on page 101. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

Hydraulic Cylinders (2D). Push, pull, lift, press, clamp or control quickly, smoothly, accurately and at low cost with these versatile power units designed for working pressures up to 1500 psi. If you have a job for one of these cylinders this 28-page illustrated catalog will point out the size and model you require. Hanna Engineering Works.

Thermocouple Connectors (2E). Eliminate errors produced by using unmatched materials in plugs and jacks. Here is a 4-page bulletin that pictures and describes several types of duplex, quick-coupling connectors made of matched thermocouple materials. Connector panels that centralize control of temperature measuring applications are also covered. Thermo Electric Co., Inc.

Combining Instrument (2F). In nearly all control systems there is need for control mechanisms, which can combine control signals. Twelve suggested applications of this pneumatically operated mechanism in automatic control circuits are described and illustrated in 8-page bulletin. Applications in computing circuits include addition, subtraction, multiplication and division, averaging, and reversal of loading pressure. Cutaway drawing in color illustrates the principles of operation and other drawings show basic design modifications for special uses. Hagan Corp.

Graphic Instruments (2G). The art of recording measured values is given comprehensive treatment in an 88-page catalog. Covers the subject of recording meters from basic design through features, specifications, accessories, supplies, charts, repairs and prices. The Esterline-Angus Co., Inc.

Electronic Instruments (2H). Pocket-sized folder describes several instruments which provide complete pressure-time studies of internal combustion engines, compressors, injection pumps and pipelines. They accurately measure and record dynamic and static pressures. Applications, installation data and specifications are given. Electro Products Laboratories, Inc.

Relays (2J). Over 150 models for every electrical and electronic application are shown in colorful 24-page catalog. Offers valuable assistance in development problems and in selecting the proper type relay to meet every requirement. Contains pictures and schematic drawings of relays. Charts list complete, up-to-date coil and contact data on every relay. Potter & Brumfield Sales Co.

Insulation Testers (2K). Compact and completely self-contained ac and dc insulation testers are covered in 2-page bulletin. Applications, special features, specifications and operating characteristics are listed. Another 2-page bulletin covers spot-of-light pointer type instruments; also, single and multi-range electrostatic voltmeters. Cole Instrument Co.

Sensing Instruments (2L). Here is the latest edition of the Wheelco Data Book and Catalog. It has 42 pages of application recommendations and pertinent information concerning instrument sensing units and associated accessories. Special items listed include resistance bulbs and wells, radiation detector, special thermocouples for plastic injection and a new molten metal thermocouple for ferrous metals. Essential data pertaining to making, checking, selecting and ordering thermocouples are presented; wire sizes and resistances are listed; temperature-millivolt curves are illustrated. This manual is a valuable asset in applying indicating, controlling and recording instruments. Wheelco Instruments Co.

Flame Failure System (2M). Reliable, positive-acting, flame-failure safeguards and controls for gas-oil conversion burners are described in an illustrated bulletin. Instruments required, installation data and specifications are given. Combustion Control Corp.

Electro-Magnetic Clutch (2N). If you need a clutch that engages and releases rapidly, try this mechanism. Circular gives data on this clutch designed for machine tool servos, table feeds, etc. Barber-Colman Co.

MATERIAL HANDLING

Batch Mixer (2P). Maximum protection from dust hazards is announced in bulletin describing rotary batch mixers. Features that provide safety even when mixing very fine materials are described in detail. Illustrations are included. Worthington Pump & Machinery Corp.

(Continued on page 29)

Are 10,000 pumps enough for you?

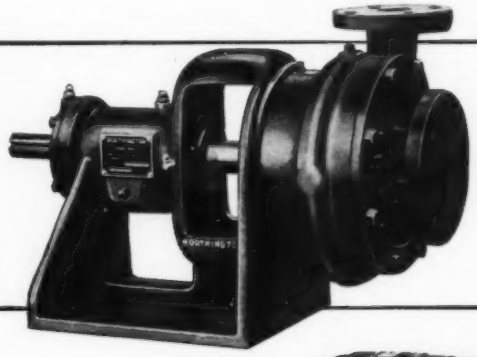
Just about. It takes that many different combinations to make sure that you—big user or small user—get exactly the right pump you need.

That's why we manufacture Worthington centrifugal pumps in over 10,000 standard combinations of capacities, heads, casings and mountings.

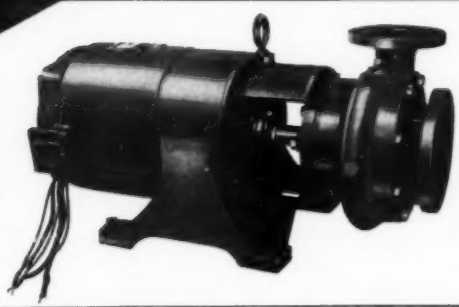
Types CN (frame-mounted) and DN (built-in motor) are made in capacities from 10 to 1800 gpm, heads to 535 ft., with 40 sizes of pump casings and 200 combinations of frame-mounted designs.

And—maximum interchangeability of parts!

Get the habit of asking for a Worthington—you'll get exactly the pump you want.

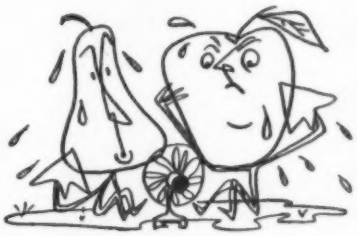


Type CN, frame-mounted, is a real "any-drive" pump—readily driven by electric motor, V-belt, or any other source of mechanical power.



Type DN is the famous Worthington Monobloc design—compact, streamlined, with built-in motor. On both types, liquid ends are interchangeable, and can be equipped with either conventional packing or mechanical seal.

The Fruit Was in a Sweat



. . . and So Was the Pump

They suddenly began having a hot time of it at a fruit and produce company near the Dillon Supply Company in Raleigh, N. C.

A centrifugal pump used in their refrigeration system had called it a day, and the temperature was rising in the rooms where the produce was kept. Without refrigeration, the perishables would have indeed perished.

But a frantic call to Dillon located, in the distributor's stock of Worthington centrifugal pumps, exactly the size needed. Prompt delivery . . . and not a lettuce leaf was allowed to wilt.

It's another example of the wisdom of depending on your Worthington Distributor. No distributor offers *more* pumps . . . no distributor offers more *value* in pumps . . . than a Worthington distributor.

WORTHINGTON

THE GOOD RIGHT HAND OF INDUSTRY

POWER TRANSMISSION: sheaves, V-belts, variable speed drives. PUMPS: centrifugal, power, rotary, steam. AIR COMPRESSORS: water-cooled, air-cooled. PC.O.B

Worthington Pump and Machinery Corp.
Pump and Compressor Merchandising Div.
Harrison, N. J.

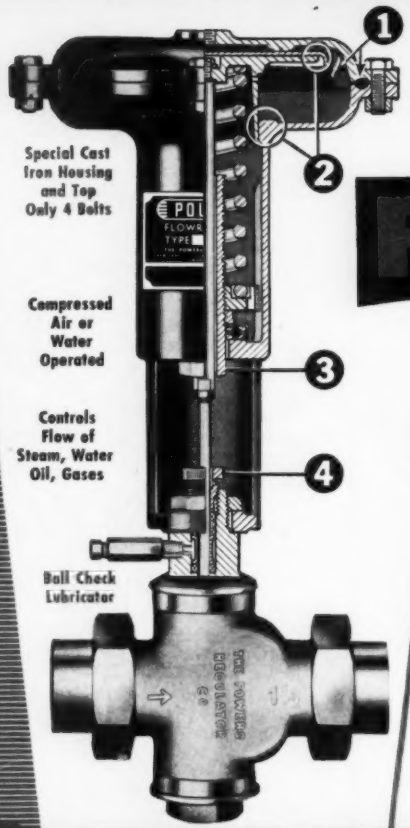
Send latest bulletin on Worthington Centrifugal Pumps. Any other (type).....

Name.....

Company.....

Address.....

City.....State.....



POWERS **FLOWRITE** VALVE

VALVE TOP—Durable moulded neoprene diaphragm (1) has positive sealing bead which provides increased sealing action with increasing control pressure. Efficient diaphragm form insures ample and constant operating power thru full travel. Piston Plate Assembly (2) has a free floating thrust plate which absorbs side thrust. Closely guided piston plate maintains stem in accurate alignment.

ADJUSTING SCREW—Ball bearing non-rising type. Easily accessible, 180° turning radius with starting pressure adjustable from 0 to 17 psi. Has enclosed rust proofed steel spring for full travel in 5 or 10 psi. control pressure change.

BONNET ASSEMBLY—Polished stainless steel stem in preformed lubricated metallic packing insures long life and low hysteresis.

VARIETY of VALVE BODIES — Sizes ½" thru 8" — For line pressures below 250 psi. Rugged construction to withstand piping strains. Single seat or double seat, bronze and stainless steel trim. Double unions and flanged ends. Available normally open (direct acting) or normally closed (reverse acting) and 3-way type valves.

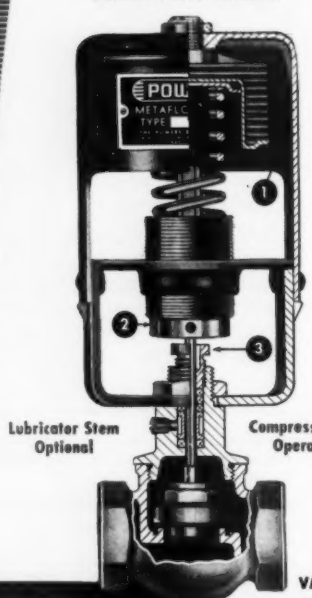
POWERS

Get TOP Performance WITH THESE

BETTER Valve Tops

AND Reduce Maintenance

Packless Valves Available



POWERS **METAFLOW** VALVE

VALVE SIZES— ½" thru 2"
Bronze bodies, screwed ends. Rugged construction to withstand piping strains.

POWERS *Metaflow Valves* are small, sturdy, light-weight, reasonably priced, suitable for many control applications where the pressure differential does not exceed 75 lbs. per square inch.

1. **HOUSING**—High strength aluminum alloy. Hydraulically formed long life brass bellows provides smooth and powerful stroke.

2. **ADJUSTING SCREW**—Brass with rust proofed steel spring having 15 lbs. adjustment range to give proper sequence operation where required.

3. **BONNET ASSEMBLY**—Polished stainless steel stem in preformed lubricated metallic packing insures long life and low hysteresis.

TRIM—Composition disc with brass integral seat and self-aligning disc holder. Available normally open (direct acting) or normally closed (reverse acting), and 3-way.

METAFLOW NO-PAK VALVES prevent leakage of inflammable or harmful liquids or gases and provide vacuum protection. Are suitable for use with Freon, oil, gasoline, non-corrosive gases, hot or cold water and low pressure steam.

Phone or Write Nearest Office for Prices

THE POWERS REGULATOR CO.

OFFICES IN OVER 50 CITIES • See Your Phone Book

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LOS ANGELES 5, CAL., 1808 West 8th St. • TORONTO, ONT., 195 Spadina Ave.
MEXICO, D. F., Edificio "La Nacional" 601

OVER 58 YEARS OF PNEUMATIC TEMPERATURE CONTROL

(FM3)

(Continued from page 26)

Magnetic Separators (2Q). Ten years of magnet research and practical experience brings you the three new models described in 2-page circular. Tells you about five new features that will help solve your tramp iron troubles. Eriez Mfg. Co.

Turning Rolls (2R). This new 75-ton capacity power and idler turning rolls makes it easier to rotate the work. Loading and unloading can be done quickly. Maintenance is simple. Features that make these advantages possible are listed in 2-page bulletin. Photographs of the units together with general specifications are included. Worthington Pump & Machinery Corp.

Overhead Handling (2S). Convert your "dead" overhead space into a "live profit zone". Here is a light crane and monorail system that is especially designed for low-cost handling of loads from 250 to 20,000 lb. Summary of the reasons where and how the system may be used is contained in 2-page catalog. Valued addition to any material handling reference file. Whiting Corp.

Automatic Air Feed (2T). If you are looking for a feed that insures extreme accuracy and speed, wide versatility, universal application, fast setup time, small investment, and simplicity, better check up on this automatic air feed that uses no rolls, gears or springs. Three actual case histories are shown in 6-page booklet. Great Western Tools, Inc.

Airless Blast Cleaning (2U). Case studies of how Wheelabrator improves the appearance and adherence of enamel finishes make up this 4-page bulletin. Tells how airless blast cleaning provides the right finish for a permanent bond. American Wheelabrator & Equipment Corp.

Single-Drum Hoists (2V). Complete line of single-drum multi-purpose hoists, with capacities from 500 to 3500 lb, is described in 16-page bulletin. Handy chart simplifies the choice of any hoist to fill a particular need. Joy Mfg. Co.

Mixers (2W). Your mixing problems should be solved with the help of these two catalogs. Portable mixers are covered in 12 pages of engineering suggestions with full operating and performance data. Top and side entering fixed-mounting mixers are presented in 16-page bulletin that gives complete engineering data. Both books contain simple diagrams and concise tables. They are ideal for quick reference. Eastern Industries, Inc

Elevators (2X). Efficient service with modern equipment that saves time and labor, and increases safe operation is graphically portrayed in 16-page booklet. Features of electronic signal control elevators are pointed out and the Autotronic Supervisory system, which is designed to team up elevators for group operation, is explained. Otis Elevator Co.

Vibrators (2Y). If you're handling powdered or granular materials you will want to read about pneumatic vibrators and accessories that increase the efficiency of bins, hoppers, chutes, etc. Detailed information and specifications on eight types are given along with photographs and drawings. Spo, Inc.

Heat Treating (2Z). Quality heat-treating with minimum labor and fuel cost is provided by one of the newest tools available to the heat-treater. Full details of rotary retort controlled atmosphere furnaces, which permit fully automatic operation of the work feeding and processing system are presented in 4-page bulletin. Diagrams illustrating typical operations are included. Surface Combustion Corp.

Centrifuges (3A). For fast, continuous, economical handling of any centrifugal filtration job, investigate the machines described in 8-page bulletin. Both screen and bowl types are completely covered. Offers testing facilities that parallel conditions in your own plant. Centrifuge Mechanical Equipment, Inc.

For more information use one of the convenient reply cards on page 101. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

Wire Rope (3B). Starting with the question "What is wire rope?", this 80-page pocket-sized booklet guides you through lays, cores, grades and constructions. Proper working loads, sheaves, drums, rollers, uncoiling, lubrication and maintenance are covered simply but thoroughly. Fittings are described and the proper method of attaching each is illustrated. John A. Roebling's Sons Co.

POWER TRANSMISSION

Speed Reducers (3C). New addition to this company's line of speed reducers —a horizontal right angle drive with gear ratios from 1 to 1 up to 4000 to 1— is introduced in illustrated catalog. Ready reference charts and an improved numbering system make it easy to select the correct reducer for any requirement. Boston Gear Works.

Right Angle Speed Reducers (3D). Minimum of maintenance and maximum of efficiency and performance — that's what this 16-page bulletin says about the all-steel right angle reducer. Adaptable to horizontal or vertical drive applications. Furnished in either the integral type or one that can be used with any foot-mounted motor. Complete data including selection tables, dimensions, and coupling information are given. The Falk Corp.

Speed Reducers & Gear Sets (3E). Quick-reference data on ratios, center distances and horsepower capacities that help in solving transmission design problems are given in 4-page engineering bulletin. Contains basic general information on standard speed reducers and gear sets ranging between 5:1 and 70:1 ratio, and from .05 up to 555 hp capacity. Standardization—for economy and easy service—is emphasized. Cone-Drive Gears Div. of Michigan Tool Co.

Open Bearing Lubrication (3F). Simple, sure, inexpensive system for spraying grease and oil to adequately lubricate open gearing and sliding surfaces is now available, according to 4-page bulletin. Cutaway views show how it works and a full description of the spray valve is included. The Farval Corp.

Gear Drives (3G). Choosing a drive is made easy by the selection tables in this 16-page bulletin. Also announces a newly developed packaged power unit consisting of a compact, enclosed helical gear drive with separate standard motor, flexibly coupled and mounted on one welded-steel base plate. Series of application photos and dimensional data along with the latest price list are included. Link-Belt Co.

PUMPS AND ACCESSORIES

Packing (3H). Profusely illustrated 20-page catalog combines in one booklet the full line of Palmetto packings. Includes the recently introduced packing for liquid pistons on inside-packed piston pumps. Self-lubricating, molded and sheet packings are covered in detailed text that points up application, structure and performance. Handy selection charts and descriptive tables on size, weights, lengths, etc. are provided. Greene, Tweed & Co.

Right Angle Pump Drives (3J). The best means of driving a vertical pump with a horizontal driver is the Gearturbo, says this manufacturer of vertical deep well turbine pumps. Especially where natural gas, gasoline, diesel or steam power is more economical or where standby power is desired. Construction features of the right angle gear head are given in 8-page bulletin along with sectional drawings and dimensions, details of the flexible shafts, hp ratings and suggested methods of application. Peerless Pump Div. Food Machinery & Chemical Corp.

Pumps (3K). Although condensed, this 12-page catalog presents a full line of pumps for handling corrosive and non-corrosive liquids, solids-carrying liquids and dry and semi-dry materials. Divided into three main sections the book shows how to select pumps for different applications and then explains their application, operation and advantages. Yeomans Brothers Co.

Sewage Ejector System (3L). Pneumatic sewage ejector costs little to operate and maintain. More sanitary, efficient and economical are some of the advantages claimed. Photos, cutaway views, diagrams, charts and tables tell you all about it in 12-page bulletin. The Blackburn-Smith Mfg. Co.

TOOLS AND SPECIALTIES

Tube Rolling Control (3M). Avoid over-rolling and over-working when expanding condenser and heat exchanger tubes. This control is designed to interrupt the current supply when a predetermined torque load is reached. 8-page bulletin explains the method and shows equipment. Crane Packing Co.

(Continued on page 32)

1500 Pounds at 1000°F.

Vogt

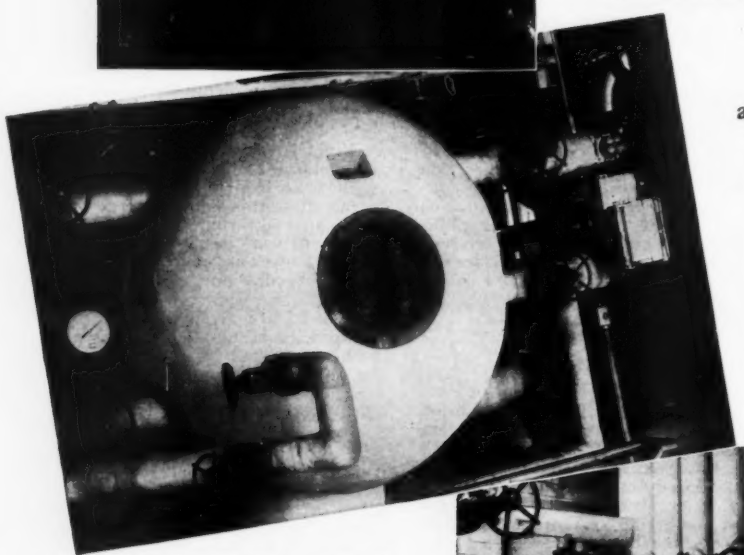
DROP FORGED STEEL

CHROME-MOLY STEAM VALVES

Hold the line at...

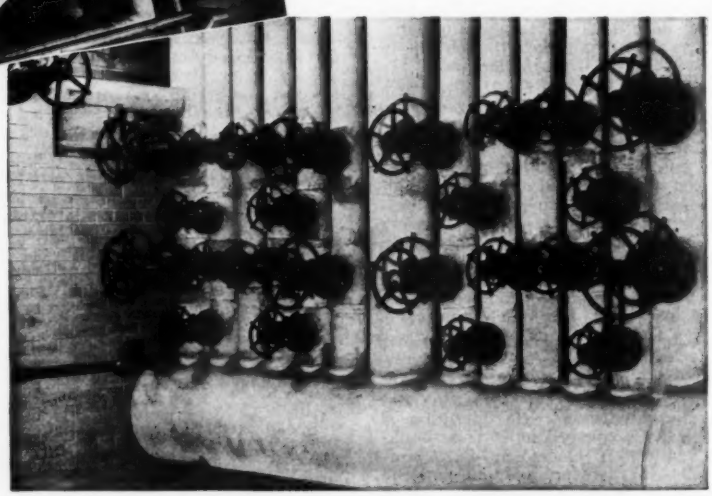
Oswego, N. Y. Station of

* NIAGARA MOHAWK POWER CO.



Leading central stations know and trust Vogt drop forged steel chrome-moly valves in their toughest high pressure and high temperature services.
Specify Vogt . . . and be SURE!

**The Huntley Station at Buffalo and Dunkirk Station at Dunkirk, N. Y. use many Vogt valves.*



TOP: Air view of Oswego, N. Y. Station of Niagara Mohawk Power Co.

CENTER: Valves on main drum of 875,000 pounds per hour steam generator.

RIGHT: Drains from main steam, attemperator, and superheater lines employ a maze of valves.

NEW CATALOG F-9
Consult its 400 pages for the complete Vogt line of drop forged steel Valves, Fittings and Flanges for steam, water, oil, gas, air and refrigeration services.

HENRY VOGT MACHINE CO., Louisville 10, Kentucky
BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS, CHARLESTON, W. VA.

Carbon • Alloy • Stainless Steel
ARTERIES for any heat transfer unit

B&W SEAMLESS AND WELDED
heat exchanger and condenser TUBES

B&W SEAMLESS and WELDED TUBES

QUICK SERVICE on your tubing requirements for original equipment or replacement is available from your nearest B&W Tube representative and through local distributors in principal cities.

Write for new Bulletin T B 329.

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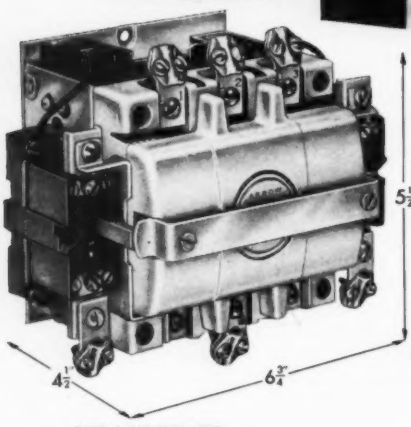


SIZE 2 ILLUSTRATED

- SMALLEST AVAILABLE
- STRAIGHT-THRU WIRING
- AMPLE WORKING SPACE IN BOX
- HIGH ARC RESISTANCE
- DEPENDABILITY.... LONG LIFE

Plant engineers, installation-and-maintenance men, and working electricians praise the Arrow-Hart Type "RA" Magnetic Starters for a handful of reasons: a small-size starter in a good-size box affords plenty of room for hands; terminals and contacts are easily reached and serviced; wiring is straight-thru all the way; all components are easy to get at; and the many extra features packed into the compact "RA" design gives the A-H starter extra dependability, puts it top of the list for performance. It's the logical starter for new equipment and for replacement. Write for FREE descriptive folder G-7005, complete with dimensions, ratings and other important data.

AVAILABLE IN SIZES 0, 1, 2, 3, and 4.

ARROW AH HART

THE ARROW-HART & HEGEMAN ELECTRIC CO.

ARROW·HART

1212 HAWTHORN ST., HARTFORD 6, CONN.

(Continued from page 29)

Vibration Absorbers (3N). Eliminate up to 75% vibration, shock and noise with Vibropad rubber mounting. A 4-page catalog section tells you what they are, how to cut and install them and shows cutaway sketches of applications on vertical and inclined machines. B. F. Goodrich Co.

Metalizing (3P). Can you save time and money on the repair of turbine shafts, pump rods or impellers, rams, rolls, etc? House organ presents a series of case studies that show proven applications of metallizing and recommended methods on a variety of machine elements. Metallizing Engineering Co., Inc.

Dye Penetrant Inspection (3Q). Interest in the diverse applications of the dye penetrant inspection method caused this company to establish an Inspection Clinic Letter. Provides an interchange of technical information and "shop talk". Very interesting and informative. Dy-Chek Co. Div. of Northrop Aircraft, Inc.

Welding (3R). "How to Weld with Haliarc Torches" is 28 pages of the latest welding information. Takes you through fundamentals, selection, preparations, operations and other data. Special 12-page section includes detailed information on properties of each metal, sketches showing types of welds, tables of welding current and welding speed. The Linde Air Products Co.

For more information use one of the convenient reply cards on page 101. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

Portable Gas Torch (3S). Circular says this new torch performs an amazing number of time and labor saving jobs. For repair work its fast, clean heat can be brought right to the work. Used for heating, melting, thawing and drying. Operates with compressed air at 40 psi or more and burns manufactured, mixed, natural, propane or butane gas. Hauck Mfg. Co.

Cold Pressure Welding (3T). Method of cold pressure welding without the use of heat or electricity is thoroughly described in 4-page bulletin. Shows various types of welds including trap, wave, stagger, sandwich and lap welds. It is applicable to many nonferrous metals, particularly aluminum and its alloys. Koldweld Corp.

Hard Metal Castings (3U). Where severe abrasion, high heats, corrosion or impact are encountered and hard facing does not quite fill the bill you would do well to investigate these hard metal castings. Uses and types are discussed in 16-page brochure. Photographs indicate the kind and size. Stoody Co.

VALVES, PIPING AND FITTINGS

Regulating Valves (3V). Looking for information on temperature or pressure

(Continued on page 116)

WE'LL BE AT BOOTH 72
AT THE POWER SHOW
Grand Central Palace
New York City...
NOV. 27 to
DEC. 2

Cinderella

Once upon a time...

...it was a near-impossible job to 'fit' a small boiler with an efficient fly ash collector. Really good collectors cost too much to put on a boiler under 2000 BHP. And when you got down to a boiler of as little as 100 BHP...*well!*

But now Buell has developed the 'LR'—a *low* resistance Fly Ash Collector—*especially* for small boilers!

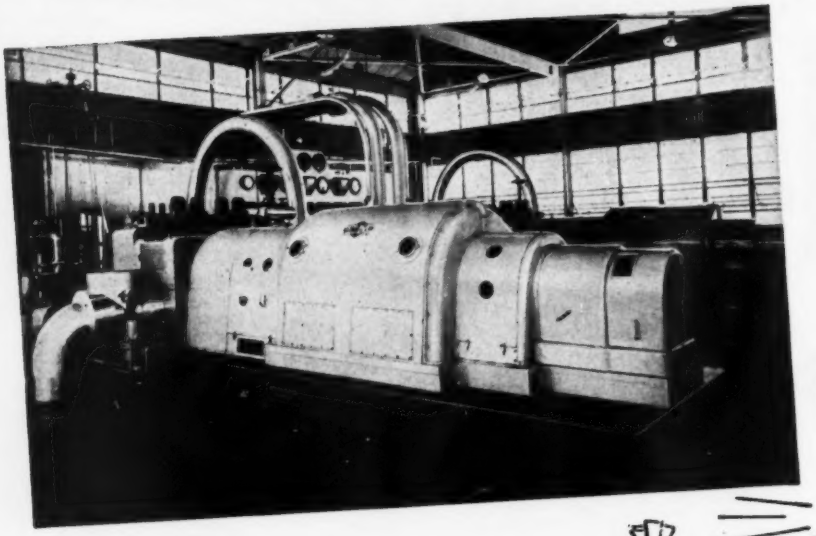
Now the small boiler operator can collect a guaranteed 99% of all 100-mesh cinder discharge. He can use the 'LR' even if his boiler is *natural draft*. And—as you will discover when you investigate—the cost of the 'LR' is no obstacle!

If you operate a coal-fired boiler between 100 and 2000 BHP, write for full information on the Buell 'LR' Fly Ash Collector. Buell Engineering Company, Suite 5017, 70 Pine Street, New York, N. Y.

buell

Engineered Efficiency in **Fly Ash Collection**

HANDLING TWO JOBS AT ONCE...



and saving money on both!

Two 1500 KW Worthington turbine-generators, installed in the Eunice, N. M. plant of the El Paso Natural Gas Company. These are non-condensing extraction turbines designed to operate on initial steam conditions of 575# — 575° FTT exhausting at 5#G back pressure.

Worthington Turbine-Generators Selected By Natural Gas Firm For Both Power and Product-Conditioning

Pumping natural gas from southeastern New Mexico and the Texas Panhandle to points in California and Arizona, the El Paso Natural Gas Company uses Worthington Turbine-Generators for double duty. Besides furnishing electricity for the company's plant in Eunice, N. M., the turbines automatically extract steam at 125#G for heating Amine solution, which is mixed with the gas to remove impurities.

In every branch of industry, users are getting daily proof of the outstanding flexibility of Worthington Turbine-Generator Sets — not only as sources of more dependable, more economical electric power, but as cost-cutting suppliers of processing steam for many important allied purposes.

WORTHINGTON TAKES ALL THE RESPONSIBILITY

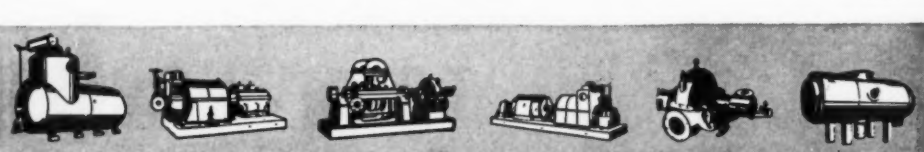
Worthington builds Turbine-Generator Sets in sizes up to 10,000 kw, and in all types. Each is designed to make steam do more work, and each is backed by Worthington's undivided responsibility for the complete unit's design, assembly and performance. For expert aid in selecting the *right* size and type for your own requirements . . . and further proof that *there's more worth in Worthington* . . . call our nearest District Office. Or write to *Worthington Pump and Machinery Corporation, Steam Turbine Division, Wellsville, N. Y.*

WORTHINGTON

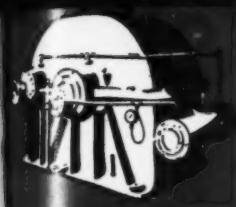
STEAM TURBINES

T.O.9

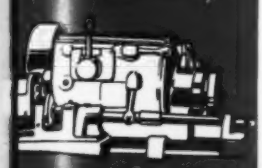
A GREAT TEAM IN STEAM



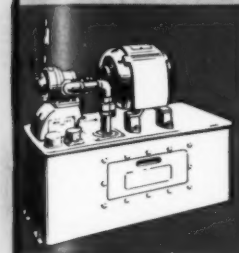
Feed Water Heaters | Multi-Stage Turbines | Boiler Feed Pumps | Turbine-Generator Sets | Single-Stage Turbines | Surface Condensers



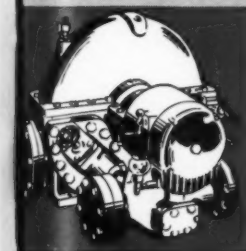
SPEED REDUCER



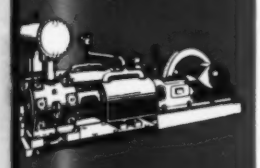
EAD STOCK GEARS



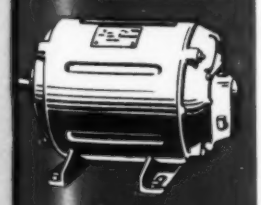
YDRAULIC SYSTEM



UXILIARY TURBINE



COMPRESSOR



MOTORS

Now better than ever

NEW

STANOIL
TRADE MARK
Industrial Oil

Brings two new benefits to wide range of jobs

For 14 years, STANOIL Industrial Oils have proved their ability to handle a wide variety of jobs in midwest plants. Now, these established products have been made better than ever! They offer these new and important savings in an even wider variety of industrial equipment.

1 LONGER OIL LIFE

Because they have greater oxidation stability, the new STANOILS stand up under high temperatures of operation, maintain low acidity for longer periods of service which helps keep oil systems free from deposits caused by oil oxidation.

2 GREATER PROTECTION against RUST

A corrosion inhibitor of the most advanced type has been added to all grades of the new STANOILS that benefit by such an additive. This inhibitor prevents corrosion trouble by "plating out" on surfaces that tend to rust. In such severe service as paper-machine and steam-turbine lubrication, new STANOILS have put an end to rust and corrosion troubles.

At the left are shown several types of equipment in which the new STANOILS can save you money and maintenance time. A Standard Oil lubrication specialist will help you find still other applications where versatile STANOILS can replace many special-purpose oils. You can reach this man quickly and easily through your local Standard Oil Company (Indiana) office. Contact him today. Or, if you wish, write: Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA)

STANDARD

Here's help for bearings in "HOT WATER"

New booklet tells how STANOLITH Greases solve wet-hot problems

HOW TO LUBRICATE bearings which operate under extremely wet conditions, and at the same time, are subjected to high temperatures? If that is one of your problems, the booklet illustrated above holds the solution.

It tells you about the outstanding qualities of Standard Oil's new STANOLITH Greases. It explains why these lithium soap products—unlike soda soap or lime soap greases—will withstand *both* heat and water. The booklet contains evidence of this ability. It gives actual case histories of some of the many different jobs on which STANOLITH Greases have eliminated troubles caused by high temperatures, presence of steam or water, and high speeds. It also describes successful low-temperature service.

Study this wide range of applications. Discover how the two grades of STANOLITH Grease not only can solve difficult lubrication problems but can save you the cost and trouble of stocking and using a variety of special greases. Send for this information. Write for your copy of the STANOLITH booklet today. Simply address your letter to:

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD

STANDARD OIL COMPANY (INDIANA

HOW SUPERIOR'S 4-pass design gives you . . .

Taper Tube EFFICIENCY

The long-lived efficiency of Superior Steam Generators results from fundamentals of design which are basically sound. Superior's 4-pass, down-draft design provides a minimum of 5 sq. ft. of heating surface for each unit of horsepower rating; **and every inch of that heating surface is effective.**

WHY 4-PASS?

Theoretically (from the standpoint of heat transfer alone) the fire passes of a perfectly designed fire tube boiler would resemble a long, very gradually tapered cone surrounded by water. The large end would be sized in ratio to the volume and speed of the combustion gases so that the gases would be crowded into the tube and thus "scrub" the walls of the tube, forcing contact between fire and tube surface. As the gases give up their heat to the surrounding water (by transfer through the tube) the gases shrink in volume. The gradual taper of the tube compensates for this shrinkage, maintaining the scrubbing action which promotes efficient heat transfer.

Such a fire tube is impractical; but Superior's 4-pass design achieves the same effect. Its 4 passes are so designed that each successive pass has a lesser number of tubes (and hence a smaller area in cross section) for the passage of combustion gases. This is, in effect, **taper-tube** performance which results in the maximum practical efficiency of heat transfer . . . performance which makes it possible for Superior to guarantee **more** than 80% thermal efficiency **under field operating conditions.**

Superior Steam Generators are completely factory assembled, backed by undivided responsibility. Burn gas or oil, or both. Manufactured in 18 sizes from 20 to 600 b.h.p. for pressures up 250 p.s.i. or for hot water.

Write today for the details in Catalog 202.

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Factory: Emmaus, Pa.
Executive Offices: Times Tower, Times Square, New York 18, N. Y.

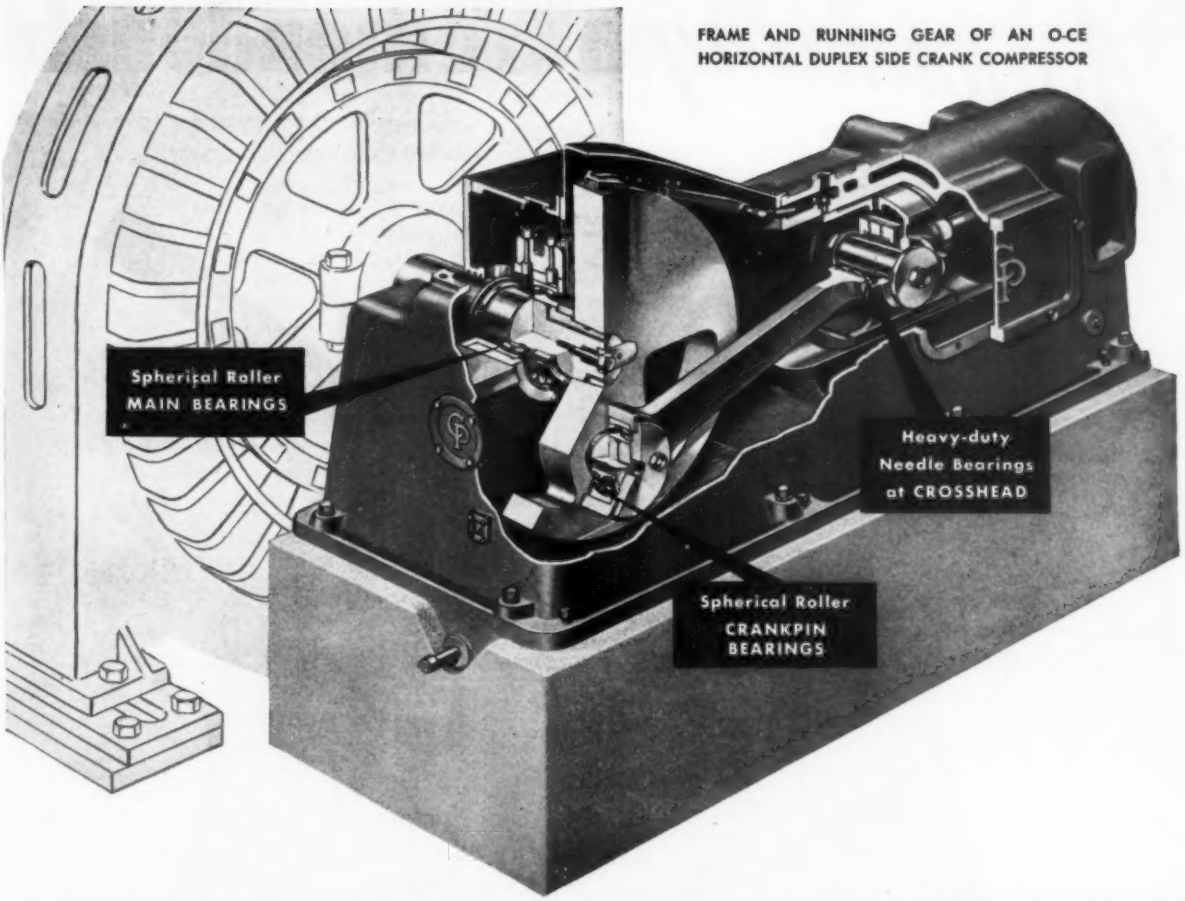
There's a Chapman Valve

for every pressure or temperature range

No matter what the power plant specification — what the pressure and temperature range — you'll find a Chapman valve to meet it. Every one is manufactured to full A. S. A. standards for port diameters and wall thicknesses — all have straight-through ports. Available in flanged, welded or pressure sealed body and bonnet connections.

At the Power Show
VISIT THE
CHAPMAN DISPLAY
Booths 46 and 47

THE CHAPMAN VALVE MANUFACTURING COMPANY
INDIAN ORCHARD, MASSACHUSETTS



FRAME AND RUNNING GEAR OF AN O-CE
HORIZONTAL DUPLEX SIDE CRANK COMPRESSOR

FIRST WITH ROLLER BEARINGS THROUGHOUT

IN A HORIZONTAL DUPLEX COMPRESSOR

- SPHERICAL ROLLER MAIN BEARINGS
- SPHERICAL ROLLER CRANKPIN BEARINGS
- HEAVY-DUTY NEEDLE BEARINGS AT CROSSHEAD

Chicago Pneumatic's Class O-CE AIR COMPRESSORS are the first horizontal duplex, side crank compressors to have anti-friction roller bearings throughout . . . spherical roller main and crankpin bearings . . . heavy-duty needle bearings at the crosshead pins.

To the user, "roller bearings throughout" means easier and cheaper maintenance, and no possibility of improper bearing adjustment with resultant serious damage to frame and running gear.

Roller crankpin bearings permit the use of solid-end connecting rods—the strongest, safest type.

This revolutionary innovation is made possible by the recent development of the oil injection method of bearing and crank disc installation and removal. This simple method, requiring only a hand-operated oil pump and ordinary hand tools, is employed also for the application or removal of gears, couplings and sleeves on shaft ends.

Class O-CE Motor-driven Compressors are furnished in sizes up to 2000 h.p.

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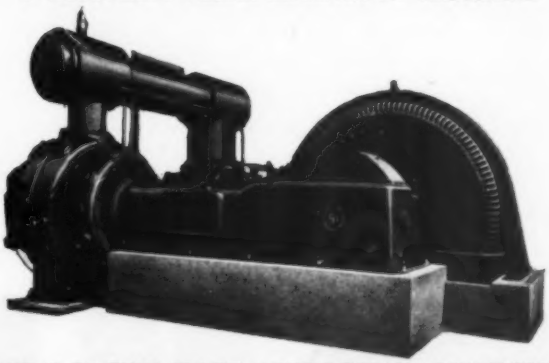

CLASS O-CE TWO-STAGE MOTOR-DRIVEN COMPRESSOR

CHICAGO PNEUMATIC
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PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
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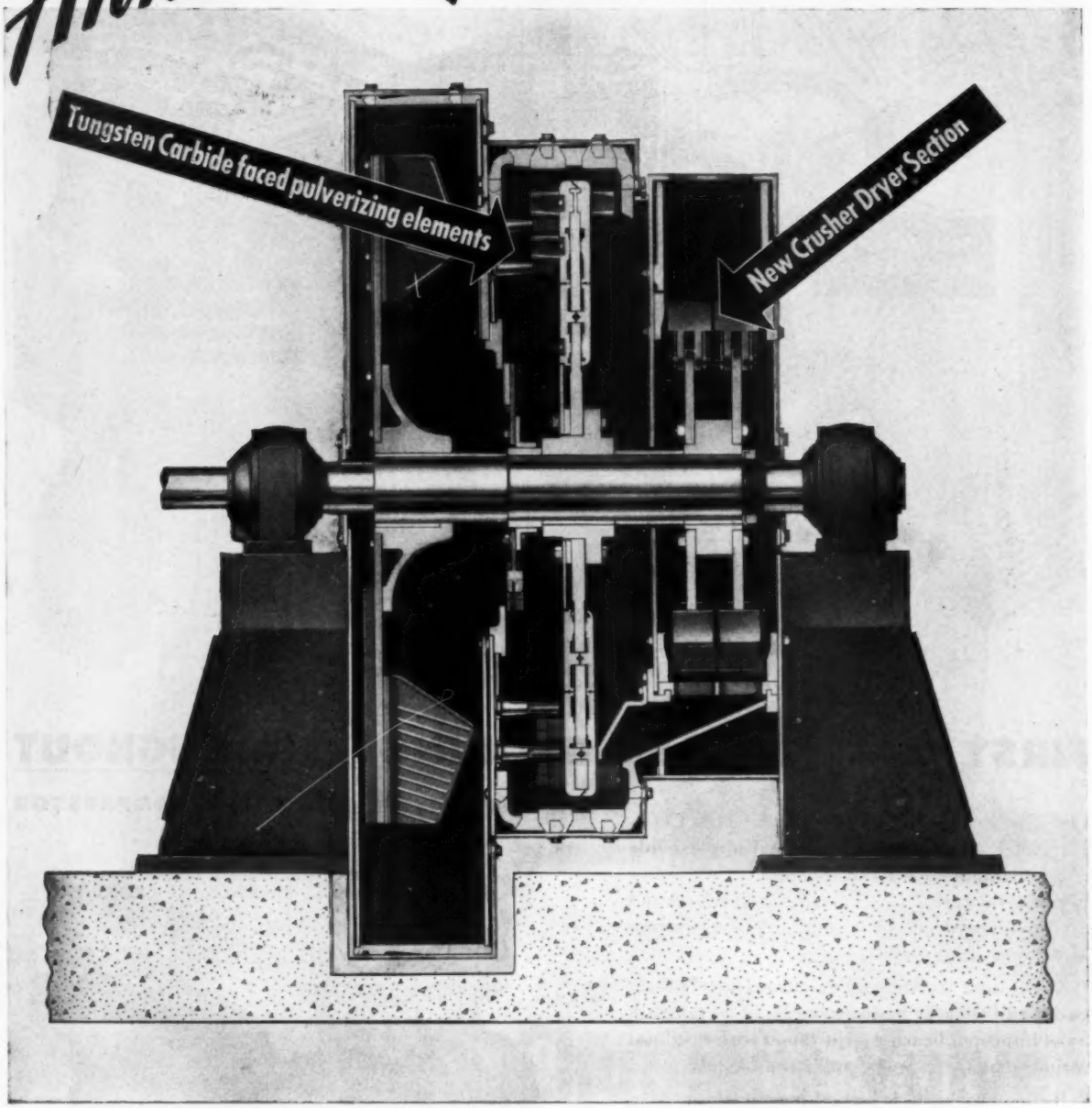
Announcing a tremendously



RILEY

STOKER CORPORATION, WORCESTER, MASS.

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BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

improved Riley Pulverizer

No capacity reduction with increase in moisture.

In the crusher dryer section where coal is crushed to a fine granular state, approximately 40% through a 50 mesh screen, representing about 5% of the work to be done, free moisture is evaporated from coal. The crusher dryer section acts as a flash dryer. Coal then enters pulverizing section where 95% of the work is done, completely free of moisture which would affect pulverizer performance and capacity. The crusher dryer section is designed with ample capacity for the highest moisture coals and as moisture is evaporated before coal enters the pulverizing section, moisture has no effect on pulverizer capacity or performance.

Tramp iron, iron pyrites and other foreign materials in coal rejected.

The crusher section of the pulverizer rejects tramp iron, iron pyrites and other hard foreign substances in the coal, preventing any materials from entering the pulverizer section which could cause damage.

Pulverizing elements faced with tungsten carbide.

Pulverizing elements are faced with tungsten carbide, assuring long periods of service without outage for maintenance and resultant low maintenance costs. Numbers of Riley pulverizers equipped with tungsten carbide faced parts have been in operation over two years without showing appreciable signs of wear, indicating at least several additional years of service before replacements are necessary. Over 40,000 tons of coal have been pulverized by a mill having a six-ton per hour capacity with indications that 150,000 tons will be pulverized before requiring replacement.

Fineness sustained over years of operation.

Because the life of the tungsten carbide faced pulverizing elements is so long, fineness of pulverization is maintained over years of operation. Tests on existing installations show no falling off of fineness after over two years of operation. No adjustments are necessary to maintain fineness.

Unusually high capacity per unit of space.

The improved Riley pulverizers have an unusually high capacity per unit of floor space and height, permitting their installation under crowded space conditions. Because of their lower weight and quiet vibrationless operation, heavy foundations are not required.

If you are interested in coal pulverizers, we believe you will find the article "THE USE OF TUNGSTEN CARBIDE IN COAL PULVERIZERS," presented at the fall meeting of the A.S.M.E., well worth reading. We will be happy to mail a copy to you without charge on request.

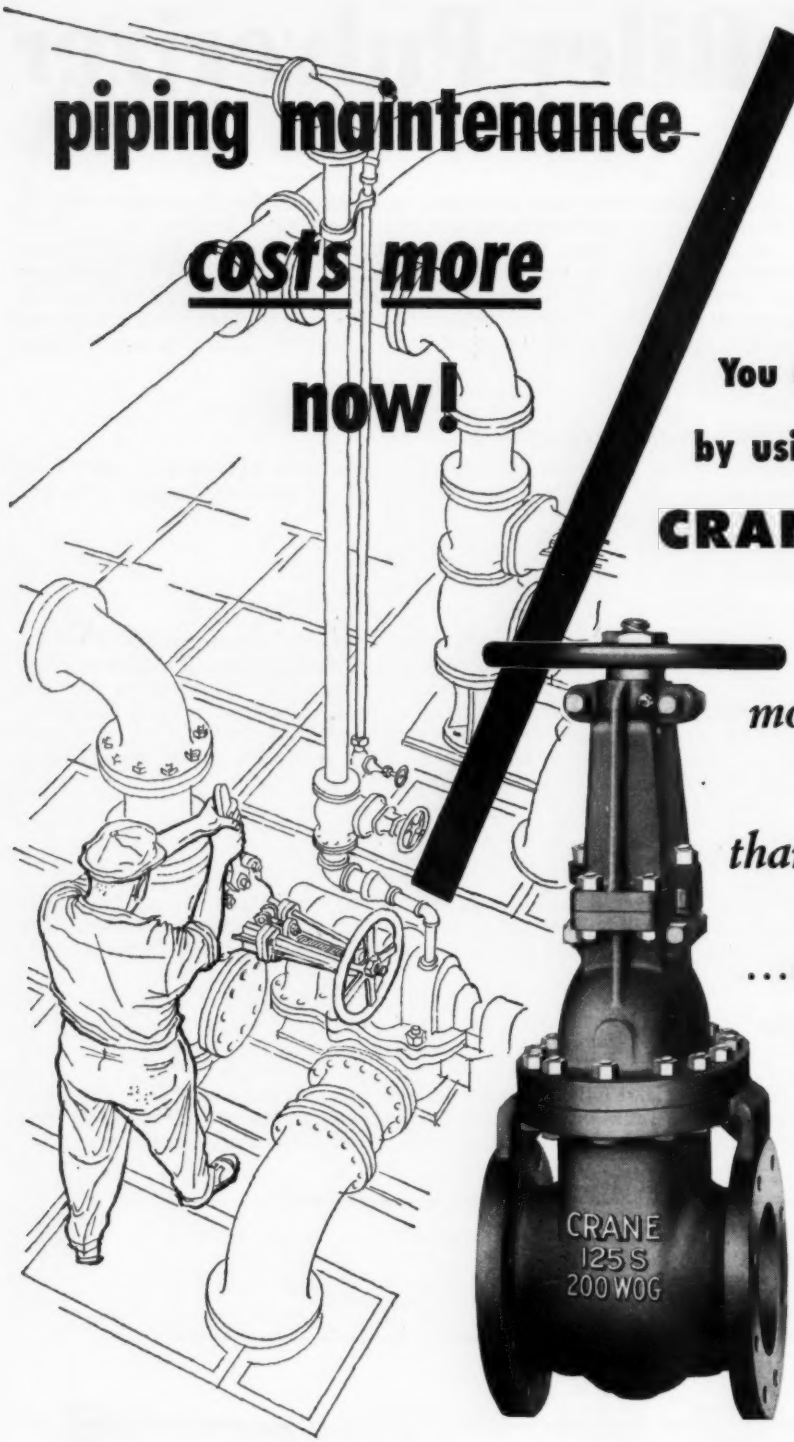
A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly [illegible] costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLA[illegible]INGS • AIR HEATERS

piping maintenance costs more now!



You do less of it

by using Dependable Quality

CRANE VALVES

That's why more Crane Valves are used than any other make

. . . no bonnet trouble with this valve

A typical example of low-maintenance Crane Quality—No. 465½ 125-Pound Iron Body Gates. Rarely does the bonnet joint need attention. Flange construction includes reinforcement to prevent distortion and utilizes more bolts, more closely spaced than is usual in valves of this class. Crane precision-guided seating reduces seat and disc wear. Packing has long life because these valves have a deep stuffing box filled with high grade asbestos ring packing. A ball-type gland equalizes the packing load.

Better performance features like these make Crane the better buy in valves of every type. Ask your Crane Representative for a demonstration.

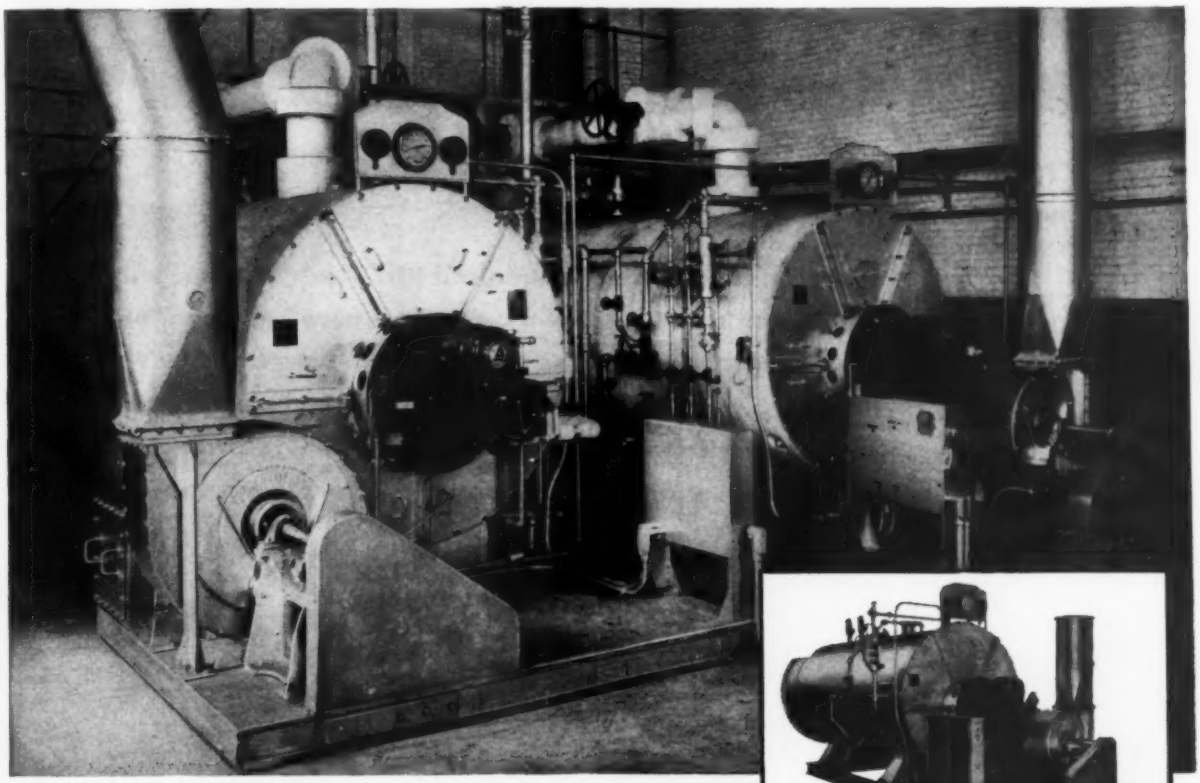
CRANE

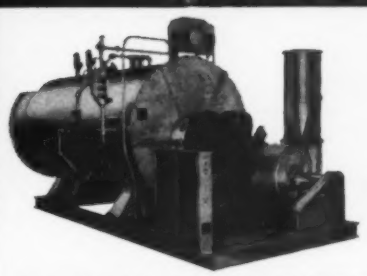
CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Habitant Soup Co. Cuts Steam Costs 35%

with Preferred Units





Here's what the Habitant Soup Co. of Manchester, N. H., reports: *"More than two years ago we installed two Preferred Unit Steam Generators and we're frankly amazed at the small amount of fuel they consume to produce more than enough steam for our requirements. In fact, they cut our fuel bills by 35%.*

"Maintenance of the Preferred units is practically nil because they are fully automatic. We're glad to report that both boilers are working like a charm."

There are a host of good reasons for these savings. Fuel costs go down, for example, because Preferred Unit Steam Generators offer fully automatic operation with inexpensive No. 6 oil. But Preferred units assure *even more* than appreciable, immediate returns on your investment. They are designed to give *continuing economical* operation for at least 25 years.

For proof, read the 25-year features in the panel at right. For full details, send for Bulletin 1000.

PREFERRED UTILITIES MFG. CORP.
1860 BROADWAY, NEW YORK 23, N. Y.

8 PREFERRED 25-YEAR FEATURES

- **4-pass, high velocity, gas travel—minimizes tube cleaning maintenance by self-cleaning action.**
- **Staggered tube construction — minimizes the possibility of tube pitting, even at low firing rates.**
- **Preferred-built 4700 rpm Horizontal Rotary Oil Burner—assures fully automatic operation even with No. 6 oil.**
- **Anti-stress deck for tube sheet protection.**
- **Self-cleaning *induced draft* fan with air cooled shaft and bearings—built to last 30 years.**
- **Down-draft gas travel for 80% thermal efficiency—proved and guaranteed.**
- **Special *precipitator* developed by Preferred as aid to safe and clean operation.**
- **Dual purging cycles for positive elimination of gas stratification.**

PR-191

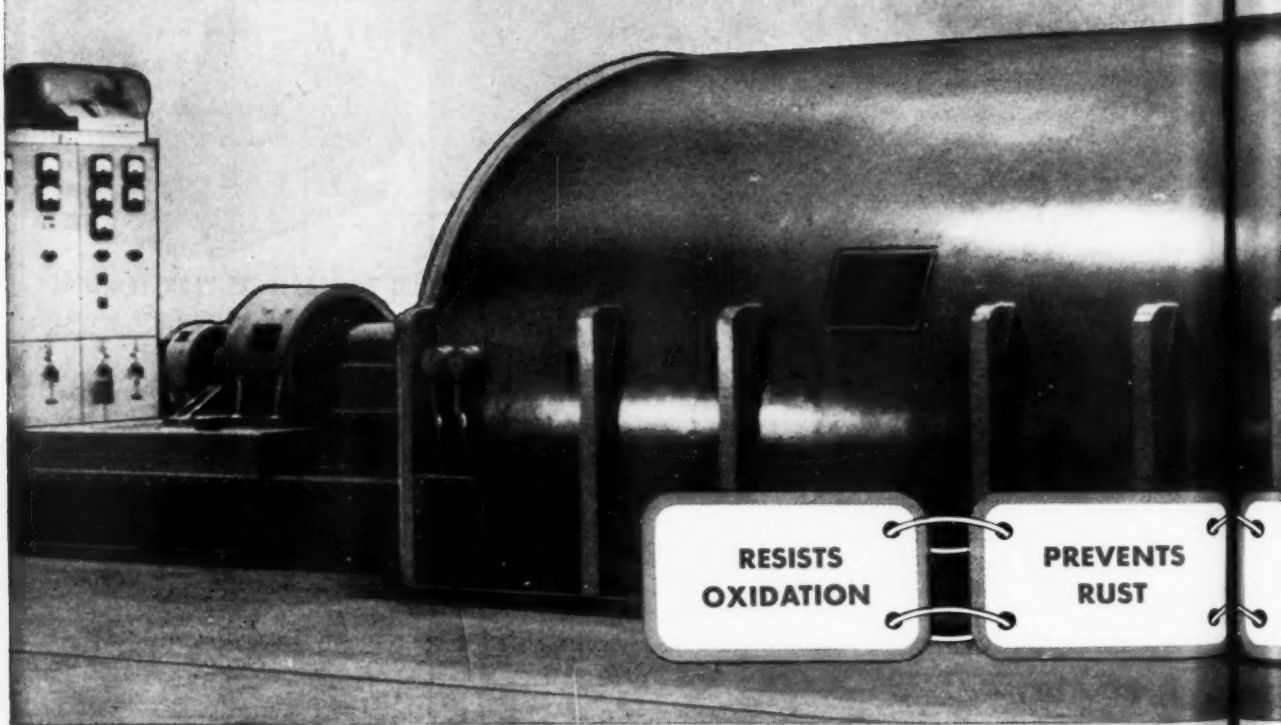
PREFERRED UTILITIES MFG. CORP.

A turbine oil

SINCLAIR

Cats seem to live a charmed life. And in many ways so do Sinclair SINTURLITE Oils! You'd expect the grueling conditions of turbine service to cut short the life of any oil. But SINTURLITE is different!

Not just for months—but for years—SINTURLITE keeps right on lubricating efficiently . . . resisting oxidation, retarding sludge formation, preventing rust, separating readily from water. Long serv-



For lubrication counsel, see your nearest Supplier of Sinclair Products or write to Sinclair Refining Company, 630 Fifth Avenue, New York 20, N. Y.

SINCLAIR

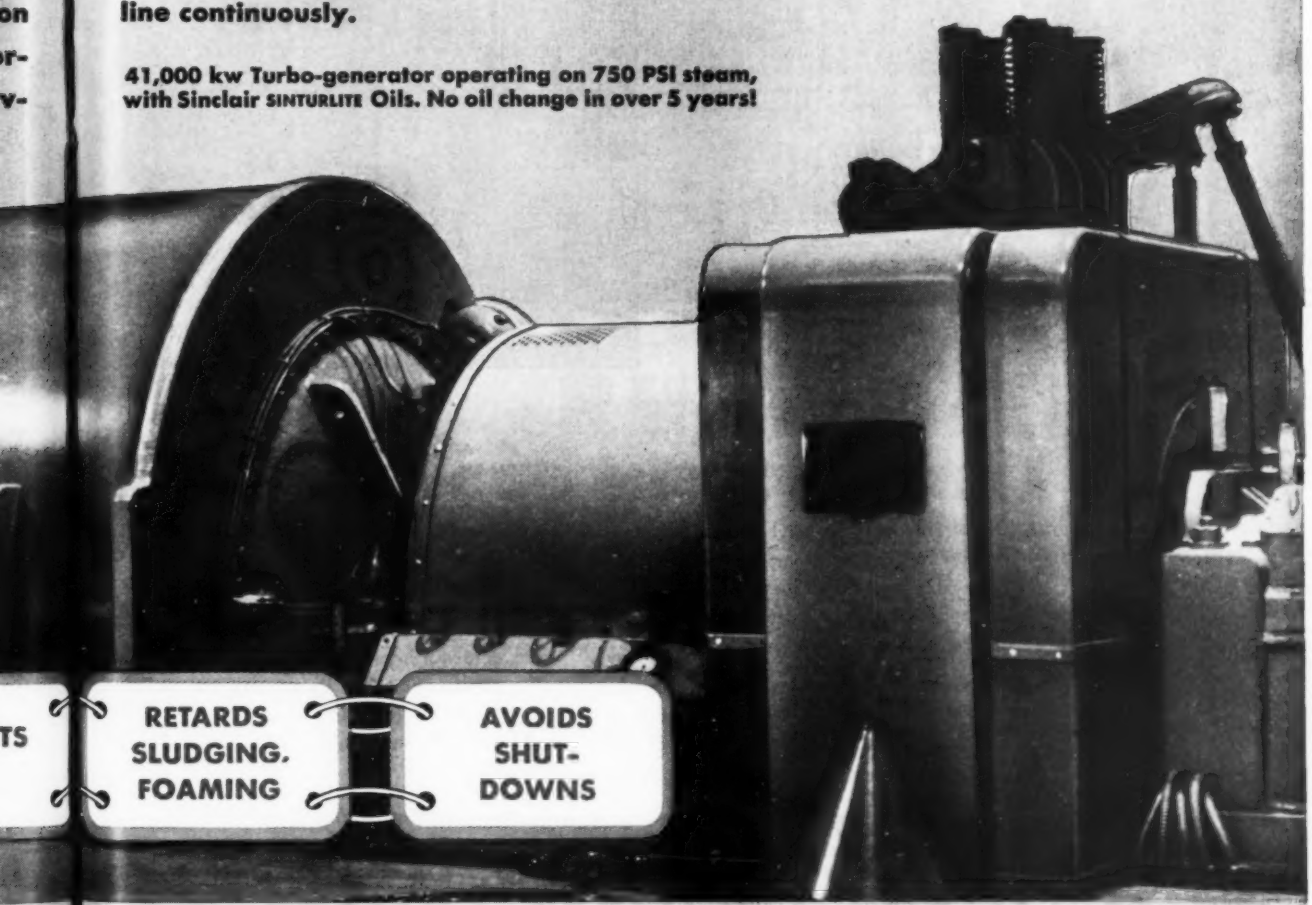
with nine lives...

SINTURLITE

ice life is assured by the superbly refined petroleum base and proven additives that are combined in SINTURLITE.

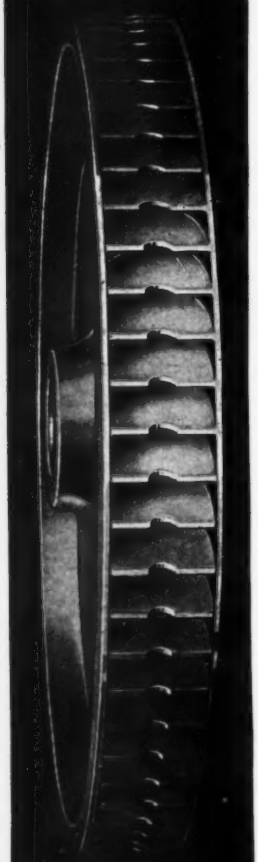
Avoid shutdowns—let SINTURLITE Oils keep your turbines on the line continuously.

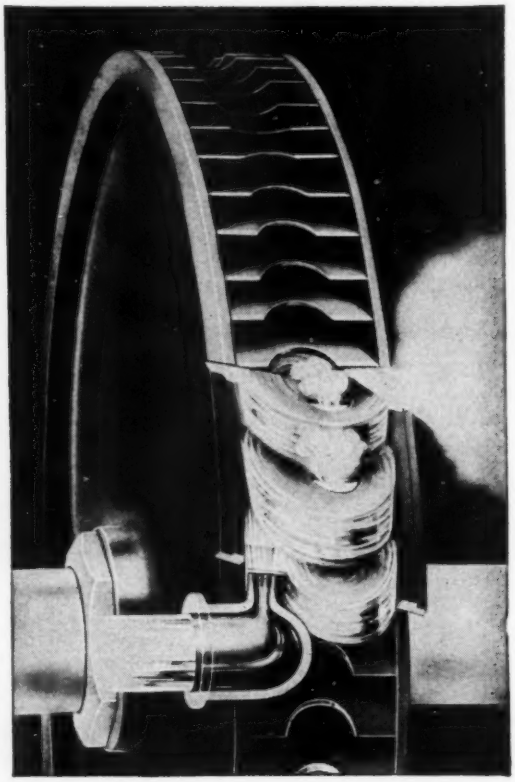
41,000 kw Turbo-generator operating on 750 PSI steam, with Sinclair SINTURLITE Oils. No oil change in over 5 years!



INDUSTRIAL OILS

TERRY





Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized.

NO PARTS TO LOOSEN OR WORK OUT

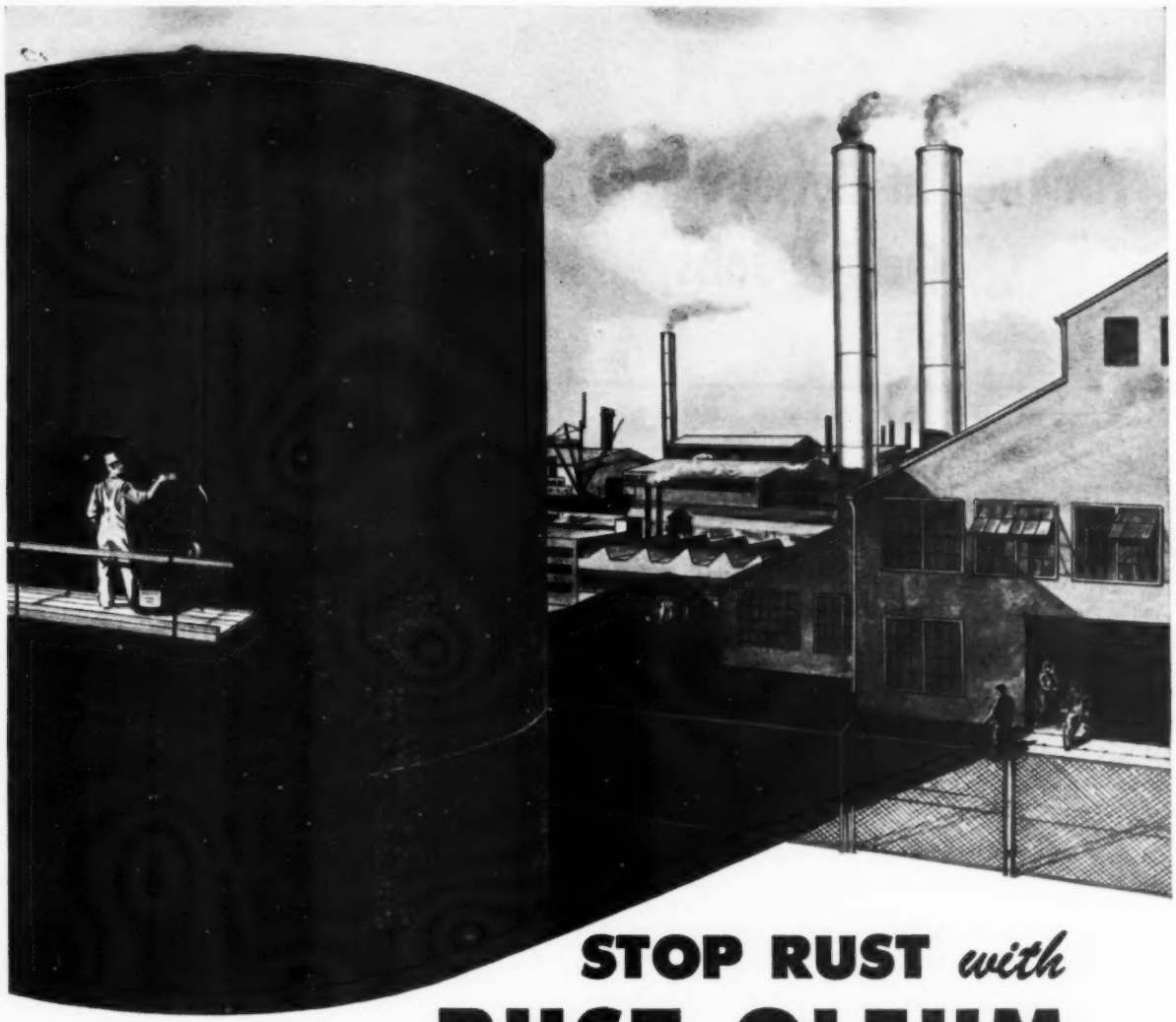
The rotor of the Terry Wheel Turbine is a single forging of special composition steel, in which a series of semi-circular buckets is milled. There are no separate parts to become loose or work out.

The power-producing action of the steam takes place on the solid curved backs of these buckets or pockets. Therefore close clearance is unnecessary and wear on the blades forming the pockets is of little consequence, as it does not materially affect horsepower or efficiency.

For detailed information about this effective construction and its advantages, write us on your business letterhead for a copy of Terry Turbine Bulletin S-116.

T-1172

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.



STOP RUST *with* RUST-OLEUM

If you have a rust problem, and would like a free survey and recommendations, send your name and address on your business stationery. A qualified factory representative will arrange this free service, which includes a trial size of Rust-Oleum for specific test purposes. There is no obligation on your part. Write today.

Every day rust eats away at your metal tanks, buildings, fences, stacks...everything metal inside and outside your plant. Yet, rust and costly rust depreciation can be *stopped instantly . . . economically* . . . with RUST-OLEUM.

Industry of all kinds...railroads, steamship lines, iron and steel companies, refineries, in fume-choked industrial and coastal areas have proved Rust-Oleum for more than 25 years. They know that Rust-Oleum stops and prevents rust!*

Rust-Oleum can be applied without extensive preparation . . . even over surfaces that are already rusted. Rust-Oleum spreads evenly . . . free of brush marks. Its tough, pliable finish protects against every kind of weather, against fumes and heat . . . even against salt air and salt spray.

Beauty and durability are combined in Rust-Oleum for it is available in a large selection of colors . . . including aluminum and white.

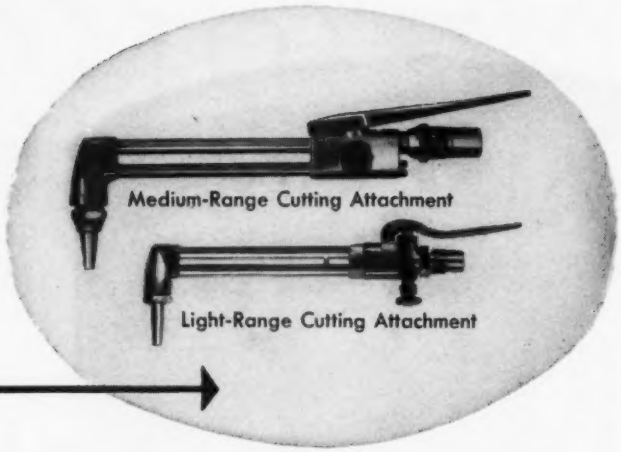
Don't wait another day! Let Rust-Oleum give you safe, sure, economical protection against rust. Use it to protect all your metal surfaces. Specify it to your painting contractor or architect. Industrial distributors in all principal cities of the United States and Canada stock Rust-Oleum to supply your every need. See Sweets for complete catalog and nearest source of supply, or write us direct.

** Names on request.*

RUST-OLEUM CORPORATION

2472 Oakton Street, Evanston, Illinois

For the "In-Between" Cutting Jobs



Trimming · Shaping · Beveling · Groove-Cutting

With a PREST-O-WELD Cutting Attachment, you can switch from welding to cutting or back again just as easily and quickly as you can change a welding head. There's no time lost. Attachment and heads fit the *same* blowpipe handle . . . and your outfit's always ready for any run-of-shop job.

One of the PREST-O-WELD Cutting Attachments shown above will greatly extend the usefulness of your PREST-O-WELD Welding Blowpipe. The CW-111 adapts the W-111 Blowpipe for cutting up to 4 inches of steel or wrought iron. The CW-110, for use with the W-110 Blowpipe, cuts up to 2 inches of steel. With the W-109 Blowpipe, the CW-109 cuts steel up to 1 inch thick.

Your PREST-O-WELD Jobber can show you the many advantages of a Cutting Attachment in your shop. Ask him to demonstrate how it can speed your work and save you time and money.

PREST-O-WELD Cutting Attachments

Medium-Range

TYPE CW-111 (75-degree or 90-degree head) with Nos. 1 and 2 Nozzles **$29.50**

TYPE CW-110 (90-degree head only) with Nos. 1 and 2 Nozzles **$29.50**

Light-Range

TYPE CW-109 (90-degree head only) with No. 1 Nozzle . **$22.00**

COMPLETE OUTFITS for every oxy-acetylene need . from **$78.75**

The term "Prest-O-Weld" is a registered trade-mark of Union Carbide and Carbon Corporation.

Order from your local Jobber

or write us for his name and address. The Linde Air Products Company, 30 East 42nd Street, New York 17, N. Y.

$1,000
Cost of a New Elgin "Double-Check" Softener $1205.00*
Cost of making your present softener into a "Double-Check" $130.00
Cost of added zeolite 71.00
201.00*
Savings
$1004.00

Here's an easy way to make a Thousand Dollars

Get added soft water without buying a new softener

One of the best ways to make money in business (too often overlooked today) is to *cut costs.* Note, for example, what the simple arithmetic above can mean to you.

Suppose, for instance, you have a zeolite water softener (of any make) that isn't doing its job right. Or suppose you need more soft water, and that you have considered buying a new softener. If the softener you contemplated buying happened to be of the popular size assumed in this example*, it would cost you exactly $1205.00 to replace it with the advanced Elgin "Double-Check" Water Softener—a mighty fine investment if your old softener is beyond modernization . . . *but*—

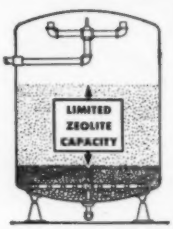
If, as in so many cases, your present softener is in basically useable condition, as little as $201.00 will pay for installing Elgin "Double-Check" Manifolds and adding Zeolite necessary to convert it into the equivalent of that new $1205.00 Elgin Softener. That *IS* an easy way to make a thousand bucks!

Make? No, more properly we should have said *save* a thousand; for you would actually *make* more than that because the greater capacity and lower operating cost of your Elgin modernized softener would quickly pay its small remodeling cost and then pile up additional savings year after year.

Thousands have profited by the Elgin modernization program. If you doubt this, simply mail the coupon below and let us send you complete information which you can consider in terms of your own conditions.

ELGIN SOFTENER CORPORATION
138 N. Grove Ave., Elgin, Ill.

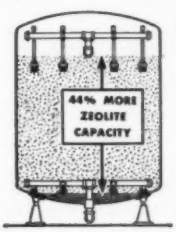
Elgin dollar-saving modernization explained:



BEFORE—

limited capacity ..

Your present softener (regardless of make) is basically as diagramed opposite. Its conventional manifold design restricts it to a shallow zeolite bed and a slow back-wash rate to prevent the escape of costly zeolite to the drain.



AFTER—

large capacity

This is the way your softener would be arranged when remodeled with Elgin "Double-Check" Manifolds. The "Double-Check" arrangement prevents escape of zeolite; permits far deeper bed and higher back-wash rate. The extra zeolite means extra soft water and the higher back-wash rate means better regeneration, more efficient use of more zeolite.

Net result is up to 44% more soft water, but this, mind you, assumes the same kind of zeolite. If, as in so many cases, your present zeolite is the old ineffective type, total replacement of it with Elgin high capacity zeolite may step up your soft water output *three to ten times.*

ELGIN
Economical
WATER CONDITIONING
FOR EVERY NEED
SINCE 1908

Send facts about softener modernization

NAME _____

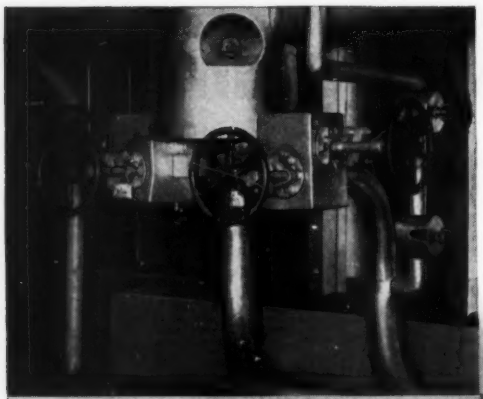
COMPANY _____

ADDRESS _____

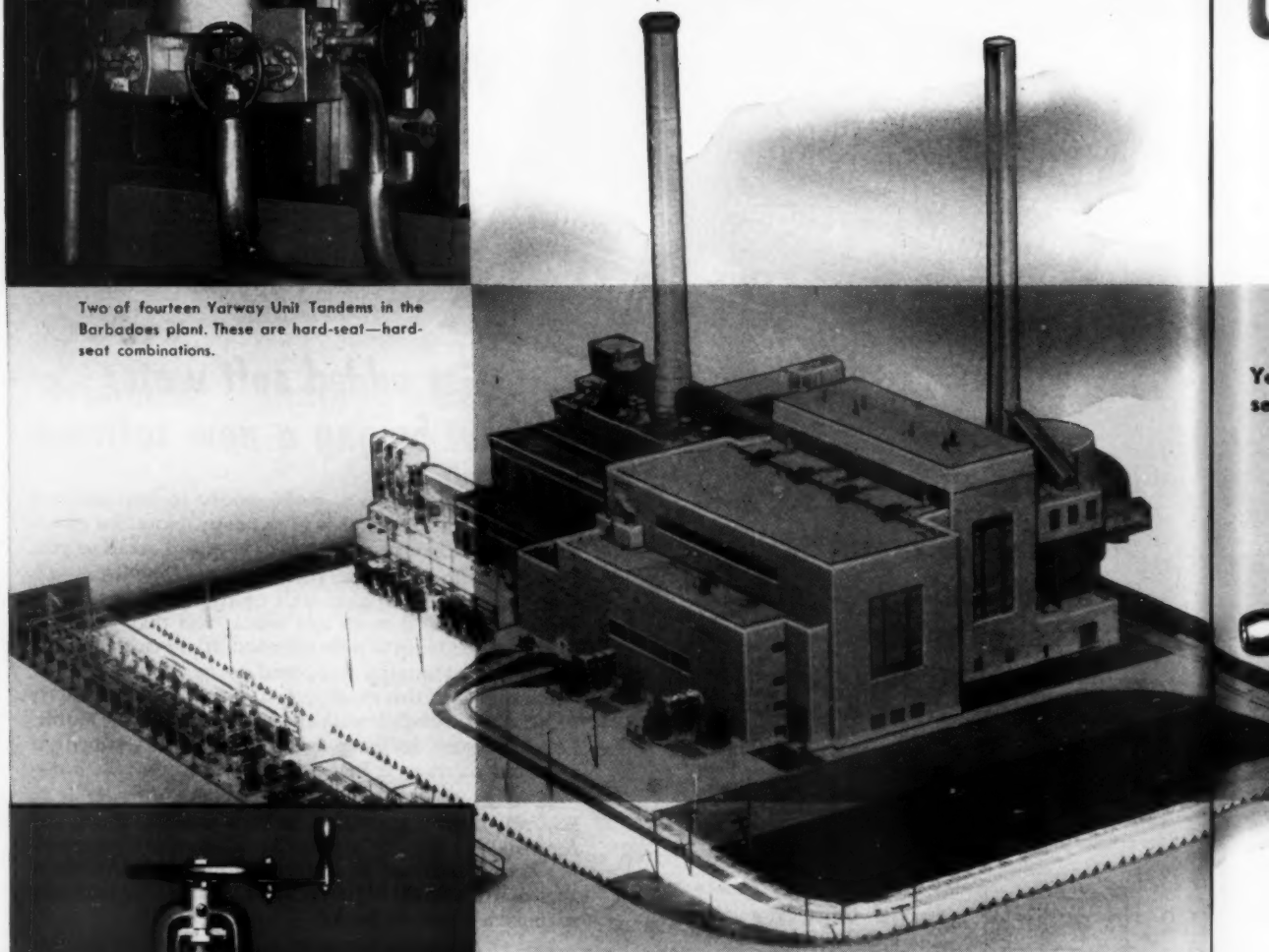
Mail to Elgin Softener Corporation, Elgin, Ill.

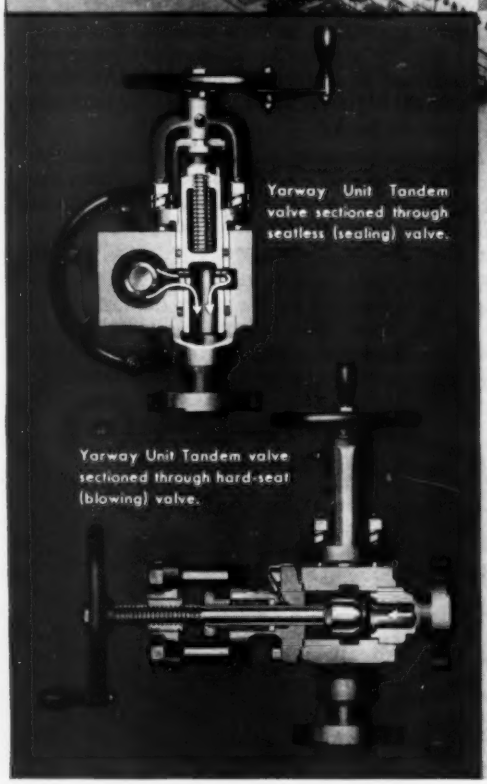
*In this typical example we have chosen the initial price of a New Elgin Softener of popular size and compared it with the cost of its remodeled equivalent. The saving would be greater if the modernized softener were larger; less, if a smaller size were remodeled. If the zeolite were completely replaced the cost of zeolite would be greater, but if total replacement were needed the greatly increased soft water output would more than justify its slight additional cost.

BARBADOES BOILERS GET



Two of fourteen Yarway Unit Tandems in the Barbadoes plant. These are hard-seat—hard-seat combinations.





Yarway Unit Tandem valve sectioned through seatless (sealing) valve.

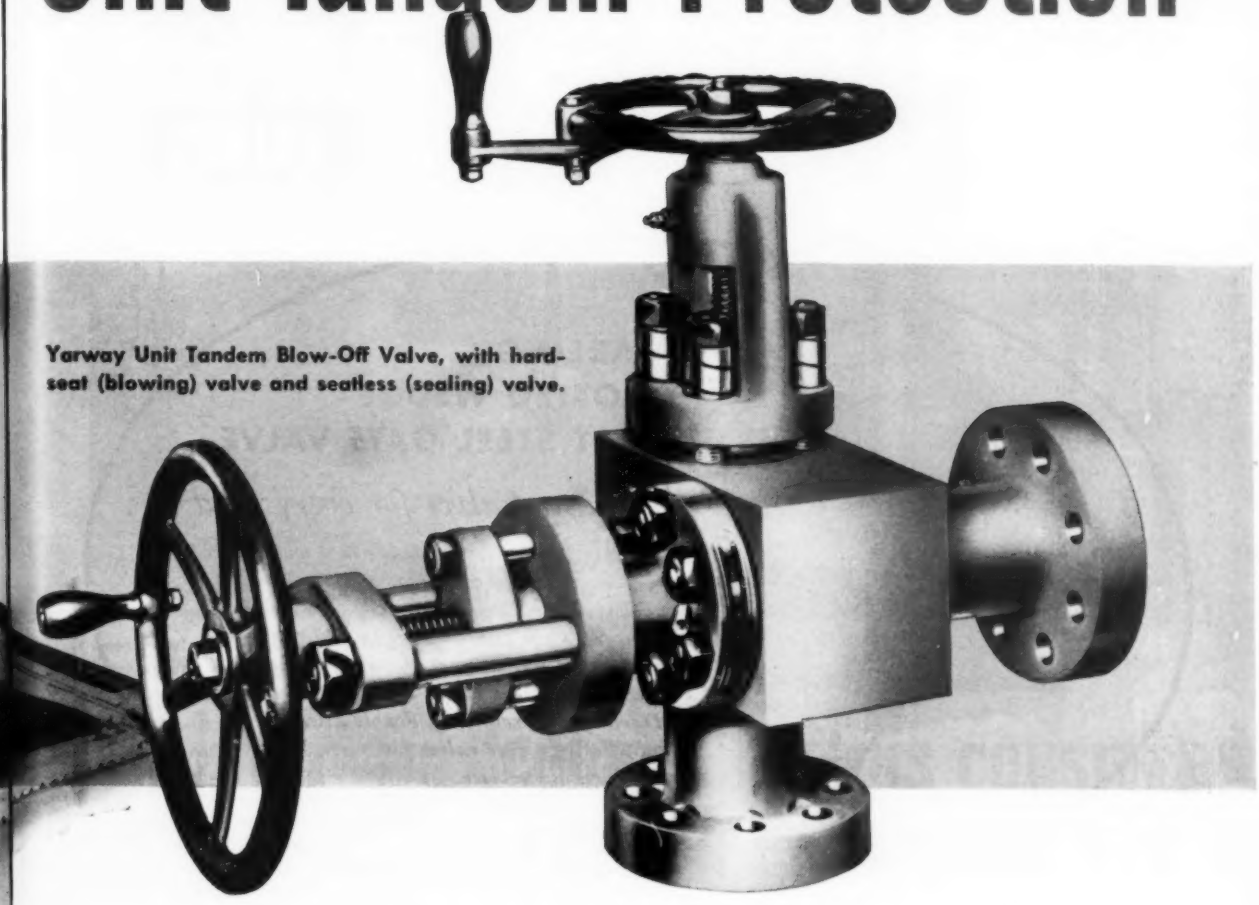
Yarway Unit Tandem valve sectioned through hard-seat (blowing) valve.

■ When a company has a $25,000,000.00 stake in the future such as Philadelphia Electric Company does in its Barbadoes Station —then protects the boilers of that plant with Yarway Unit Tandem Blow-Off Valves—it's significant of the dependability of those valves.

Barbadoes is a fine example of modern power plant engineering, demonstrated by the fact that only 11 men per shift are needed for operating this 180,000 KW station.

YARWAY

Unit Tandem Protection



Yarway Unit Tandem Blow-Off Valve, with hard-seat (blowing) valve and seatless (sealing) valve.

Yarway Unit Tandem Blow-Off Valves also are a good example of steam equipment engineering—used in more than 4 out of 5 high pressure boiler plants in the country.

Rugged construction makes Yarways strong and tough enough to withstand severest blow-down conditions. Metallurgical improvements make them resistant to the reactions of periodic acid wash. *Outages are rare where Yarway boiler valves are used.*

Unit tandems are available in various combinations to meet all pressure and service requirements.

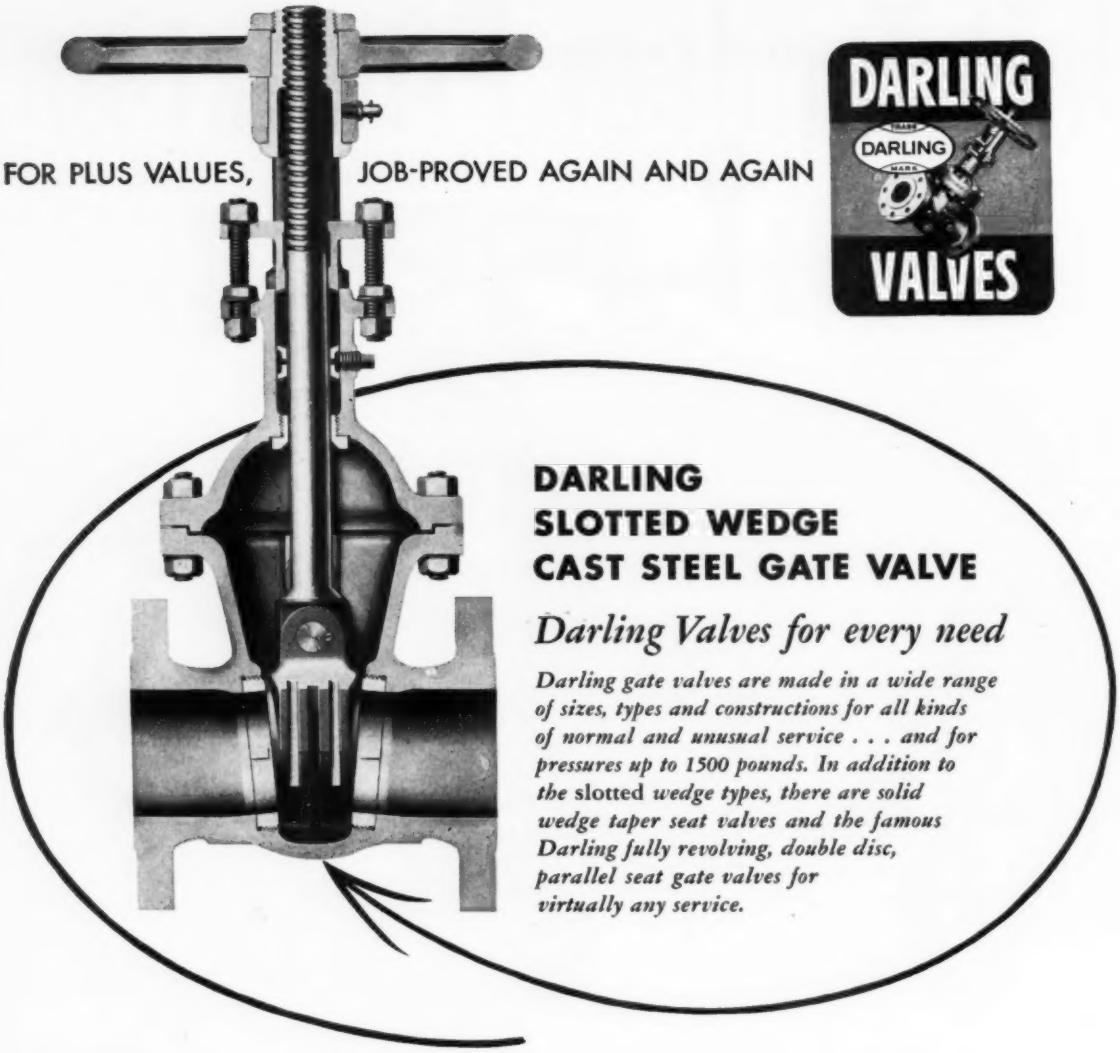
Write for Bulletin B-433 for full details on Yarway Unit Tandems. For lower pressure blow-off valves, write for Bulletin B-424.

YARNALL-WARING COMPANY
109 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

STEAM PLANT EQUIPMENT

FOR PLUS VALUES, JOB-PROVED AGAIN AND AGAIN

DARLING VALVES



DARLING SLOTTED WEDGE CAST STEEL GATE VALVE

Darling Valves for every need

Darling gate valves are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 1500 pounds. In addition to the slotted *wedge types, there are solid wedge taper seat valves and the famous Darling fully revolving, double disc, parallel seat gate valves for virtually any service.*

It's so easy to cinch improved valve performance!

LET'S skip the details on sound metal, high strength and precision—the things you'd naturally expect in *any* quality gate valve. Instead let's consider . . .

SLOTTED WEDGE . . . *Allows compression of the wedge. Compensates for valve body expansion or contraction due to temperature changes. Thus tight closing and easy opening are assured, with far less wear and tear on wedge faces and seats.*

DOUBLE-GROOVED WEDGE . . . *Double grooves, with corresponding twin ribs in valve body, provide twice the usual bearing area for more positive, more lasting alignment. This eliminates wedge canting due to line pressure, preventing damage to downstream seat.*

Take a moment to weigh the lasting, money-saving advantage of these features. Prove to *yourself* how easy it is to profit by longer valve life, less maintenance and less trouble.

WRITE FOR BULLETIN

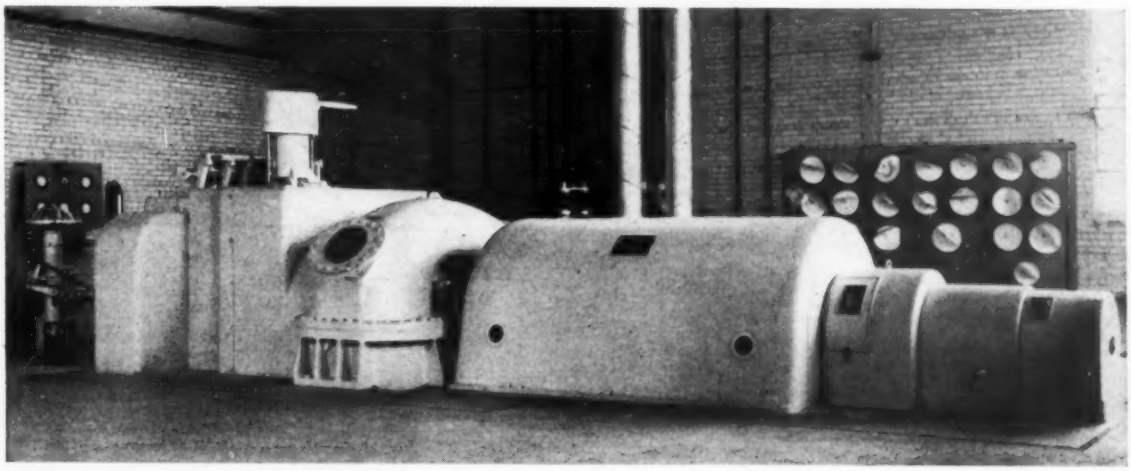
Simply outline your service requirements, including pertinent data, or ask for bulletin on cast steel valves.

DARLING VALVE & MANUFACTURING CO.

Williamsport 9, Pa.

INDUSTRIAL POWER

December, 1950 Vol. 59, No. 6



Double extraction condensing 5,000-kw turbine generator operates at 600 psig and 750 F and has two bleed points

CORRECT PLANS CONSIDER FUTURE EXPANSION TOO

Before the American Box Board Company attempted to increase its Filer City power generating plant a thorough study was made to ascertain the immediate needs and future requirements. Investigations indicated plans should be flexible to care for anticipated expansion

R. L. HARMER, ***Plant Engineer, American Box Board Co.,***
L. D. BECHTEL, ***Consulting Engineer, Carroll, Bechtel & Langtry***

THE American Box Board Co. of Grand Rapids, Michigan, in 1948, acquired the pulp and paper manufacturing plant formerly known as the Filer Fiber Co. in Filer City, Michigan. An extensive expansion and modernization program for the entire plant was inaugurated necessitating increased power service facilities for the changes plant production would experience and require.

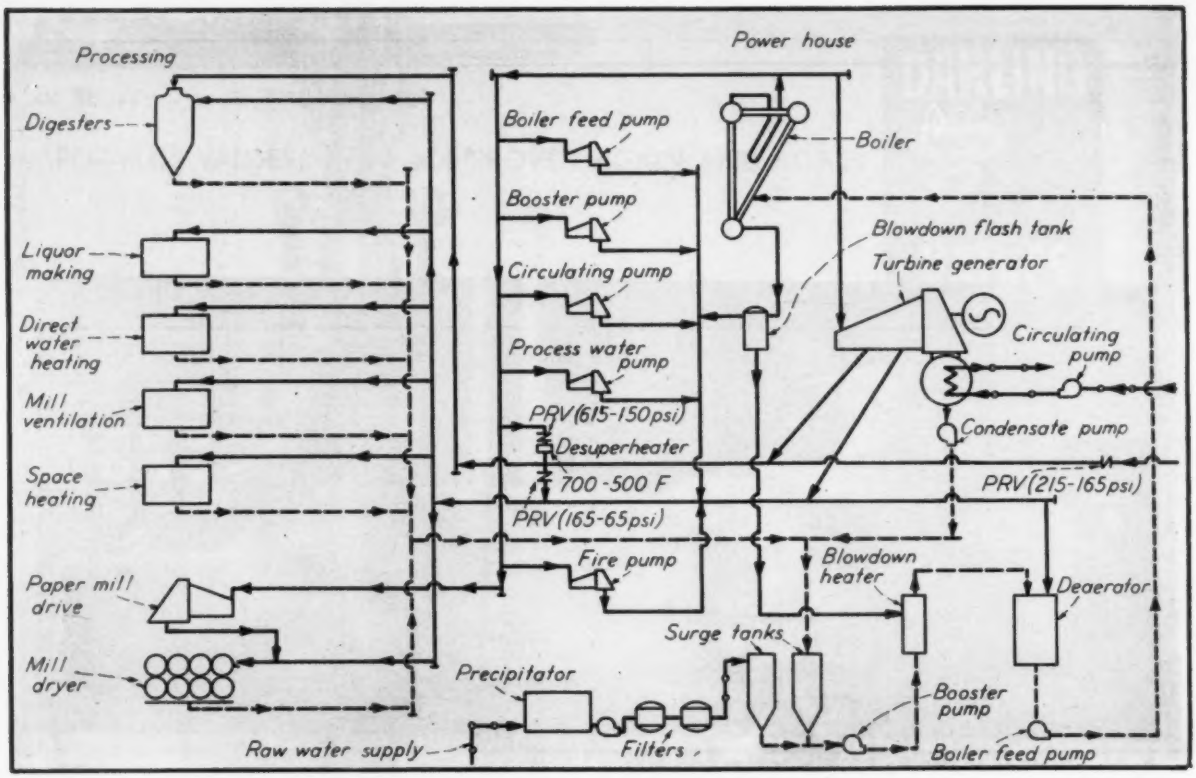
Mill expansion and modern mill economics required the furnishing of various quantities of steam at pressures of 600, 150 and 50 psig with the 600 psi steam requiring a total temperature of 750 F. Further investigation indicated that the program would need an electric current in excess of existing turbine generator capacities.

Existing steam generation consisted of one pulverized fuel fired 90,000 lb per hr boiler approximately ten years old, and two 40,000 lb per hr (each) units fired by underfeed stokers approximately thirty years old. All were designed for steam conditions of 200 psig and 500 F TT at the superheater outlet. In addition one black liquor heat recovery unit was available with a capacity of 35,000 lb per hr.

Existing electrical power equipment consisted of one 1500-kw condensing and two 750-kw (each) single extraction condensing turbine generators. These units were designed for steam conditions at the throttle valve of 200 psig and 500 F and generated 480-v, 3 phase, 60 cycle alternating current.

Maintenance was relatively high, and usability was questionable. Water rates were high, reflecting in high unit costs for power service per ton of finished product. After careful inspection and evaluation a decision was made to consider the 90,000 lb per hr boiler and 1500-kw condensing turbine generator as standby equipment for normal plant maintenance and emergency operating conditions.

Maximum, minimum and average steam demands at various pressures, as well as electrical demands for process manufacture were studied and applied to heat balance diagrams. Considering that a quantity of 600 psig 750 F TT, 150 and 50 psig steam is required for process manufacture, the evaluation then indicated the installation of a boiler designed for 615 psig and 750



Steam balance at the Filer City plant was made possible only after a comprehensive study of all processing needs.

Demand calls for 600, 150 and 50 psig steam, which is furnished directly from the boiler and turbine bleed stations

F TT at the superheater outlet with a capacity in excess of peak demand.

As greater quantities of lower pressure steam are required for process, evaluation then indicated the installation of a double extraction condensing turbine generator. This unit provides a means of pressure reduction (150 and 50 psig) and flexibility of condensing. At the same time electric current is generated more or less as a by-product. With condensing expected to be held at the minimum, the by-product power is furnished to plant process at a very economical figure.

In planning strong consideration was given to future expansion and increased plant production. With this in mind, the new boiler house was designed to accommodate the installation of one new boiler and its auxiliaries with a temporary end structure for future expansion and installation of a second boiler. The turbine generator room is designed to accommodate a double extraction condensing unit along with necessary auxiliaries, and provision has been made for the future installation of a second turbine generator, of a back pressure type.

A two drum integral furnace boiler was selected, designed for a continuous output of 125,000 lb of steam per hour with a four hour peak of 140,000 lb when consuming a low grade Midwestern coal. Drum design pressure is 675 psig, with 615 psig at the superheater outlet. The heating surface is 11,753 sq ft including tangential tube water walls. Furnace volume is 7817 cu ft, and a heat release of 21,600 Btu per cu ft per hr at 125,000 lb per hr is provided.

An inverted drainable loop type of superheater provides a reasonably flat superheat temperature curve from about half load to peak load conditions. Normal superheat temperature at the superheater outlet is 750 F TT.

Air heater having two passes and 21,600 sq ft of heating surface supplies preheated air for the coal pulverizers. An air by-pass system provides a means of corrosion control within the air heater at low load demand periods.

Two ball-mill coal pulverizers of the ball and race type furnish sufficient fuel to produce a maximum of 75,000 lb of steam per hr when burning the coal specified and coal surface moisture is 20 per cent. Each mill is driven by a 125-hp motor and is equipped with a pressure exhauster fan and integral table feeder. The pulverizers are isolated from structural foundations in order to minimize possible vibration transmission to the boiler and building structural steel.

Four circular type burners mounted in a common wind box introduce pulverized coal and air mixture to the furnace. Each pulverizer mill serves two burners. In addition, the burners are designed to fire heavy industrial fuel-oil as a multi-fuel feature, and all four burners when operating on fuel oil are capable of producing full capacity.

Boiler unit is equipped with full mechanical draft operation. This includes forced and induced draft fans motor driven, automatic combustion control and instrumentation, and automatic feedwater control.

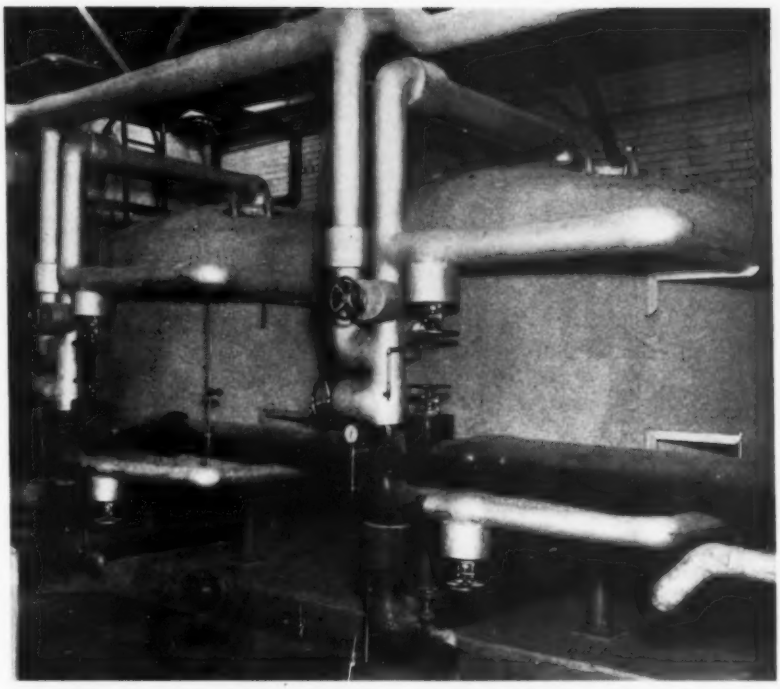
Provision in air preheater and duct arrangement design has been made for future installation of mechanical dust collecting equipment if it becomes necessary. Arrangement design made possible the utilization of an existing 250 ft concrete stack, which has ample proportions to accommodate the new boiler and a similar one in the future.

Boiler performance when generating 125,000 lb of steam per hr at 615 psig and 750 F TT with feedwater at 298 F is as follows:—CO_2 leaving furnace 15.5%; CO_2 leaving air heater 15.0%; air temperature entering air heater 80

F, leaving air heater 505 F; flue gas temperature leaving air heater 345 F; flue gas volume is calculated at 173,000 lb per hr with a total of 136,500 lb per hr of air required for combustion; draft loss through boiler and superheater is 2.4 in. water and through the air heater 3.3 in. water.

The boiler unit is so arranged that the burners or boiler front faces the cross-sectional center of the building. When the future boiler is installed, the burners will be directly opposite each other. Each boiler will then be served by a common operating platform. The reason for this arrangement is twofold: (1) it provides space on the ground floor for possible installation of a bark-burning furnace in the future, and (2) space was limited between the stack, railroad track and proposed wood handling buildings.

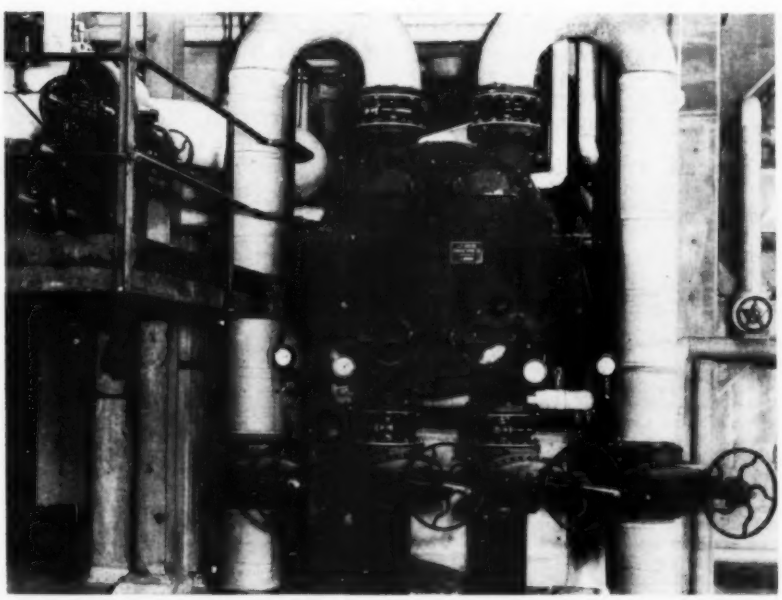
Coal is normally delivered by boat to an open dock storage some distance from the plant. From this point it is hauled by truck to a railroad track hopper and passes through a coal crusher, or it can by-pass the crusher if necessary. A double chain bucket elevator delivers the coal to a horizontal rubber belt conveyer that serves two circular 60 degree conical bottom coal bunkers by means of a tripper. Each bunker has a capacity of 100 ton and individually supplies either coal pulverizer through an automatic coal-scale located between the bunker outlet valve and pulverizer feeder hopper. The bucket elevator and part of the horizontal belt conveyer are housed in a temporary structure for the addition of two future bunkers.



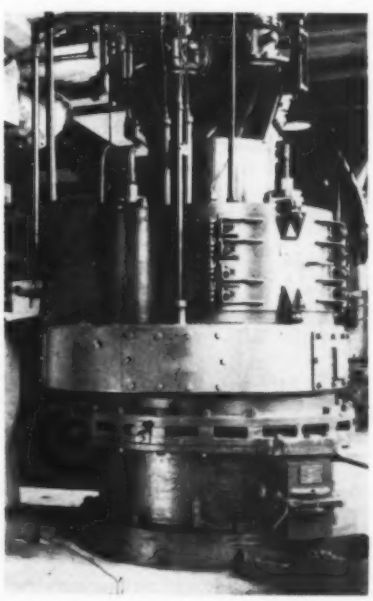
Raw water from a nearby lake passes through a precipitator and into these pressure filters in the water treatment process. Make-up is approximately 40 per cent

Ash handling system is an extension of a hydraulic conveyer previously installed, about one year prior to this program. Branch lines from the main section connect to boiler and air heater hoppers and to the existing concrete stack base. Ashes, sluiced to a pit where excess water drains off, are recovered and sold for commercial use. Provisions have been made to accommodate ash removal service for the future boiler.

Condensate return from process manufacture and heating is received in two

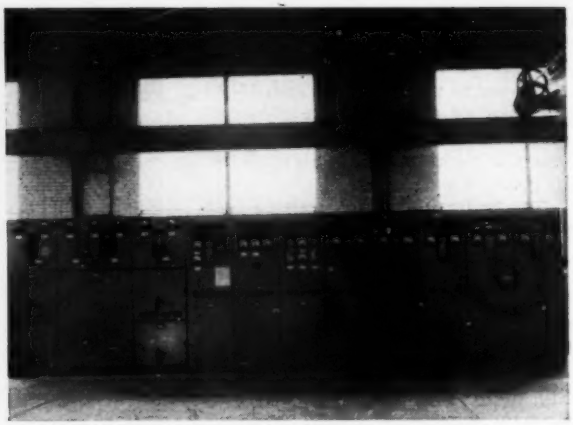


Two-pass surface condenser handles 50,000 lb of steam per hr when circulating 5,000 gpm of 75 F inlet water. Discharge is into a process service storage sump



Ball mill pulverizers are isolated to prevent transmission of vibration

Horizontal rubber belt conveyer serves two circular 60 degree conical-bottom coal bunkers that have 100-ton capacity



Switchgear consists of generator and six feeder sections. Breakers are air type of 250,000-kva interrupting capacity

large storage tanks, to which treated make-up water is added. Make-up water is approximately 40 per cent and is obtained from a nearby lake. An entirely new feedwater treatment plant is installed adjacent to the boiler house. Incoming raw water is pumped into a concrete precipitator, and automatically controlled amounts of chemicals are added. Make-up water passes through pressure filters, into sodium zeolite softeners and is finally pumped into the condensate return storage tanks.

Brine storage mixing tank and pump are provided to regenerate sodium zeolite softener as required. Ample space for chemical storage is available above the feeders, and filling the hoppers is an easy matter.

Boiler feedwater is pumped from the condensate return and make-up water storage tanks to a steam atomizing type deaerator, which has a ten minute storage at normal operating conditions. The deaerator storage tank bottom is approximately 35 ft above the three boiler feed pumps. Boiler water level is controlled by an automatic flow regulator system.

Boiler blowdown is discharged into a flash tank, and resulting steam is piped to the deaerator. The blowdown passes through a feedwater closed heat exchanger and discharges to the sewer. The closed feedwater heat exchanger is installed between the softeners and condensate return storage tanks. It provides a means to preheat raw water make-up prior to mixing with the condensate return system.

Turbine Generator

A double extraction condensing 5000-kw turbine generator unit operates at 600 psig and 750 F TT and 1.5 in. Hg abs. Power generated will be 2400/4160-v, 3 phase, 60 cycle current with neutral grounded through a resistor. First bleed point is designed for a maximum flow of about 113,000 lb of steam per hr at 150 psig, second bleed point is designed for a maximum flow of about 109,000 lb of steam per hr at 50 psig. Extraction is automatically controlled by process demand, and the balance of steam in the turbine is condensed.

Two-pass, 4500-sq ft surface condenser handles 50,000 lb steam per hr and produces a vacuum of 2.09 in. Hg abs when supplied with 5000 gpm circulating water at an inlet temperature of 75 F. These conditions are based on 85% commercially clean tubes.

Two pumps, one motor and the other steam turbine driven, return condensate from the process system. Two water pumps, one motor driven and one dual driven, circulate water from the lake through the condenser and discharge it to a concrete sump storage to supply the process service pumps. In this manner the process make-up water is tempered.

Power distribution system is 3 phase 4160-v. Distribution is underground to six load centers or unit substations. The power house substation functions as the tie between the new 4160-v bus and the existing 480-v bus. High voltage switchgear consists of generator section and six feeder sections. Breakers are air type of 250,000-kva interrupting capacity. Unit substations are 1000-kva except the powerhouse unit, which is 1500-kva. Secondary breakers are drawout type and range from 25,000 amp interrupting capacity to 100,000 amp. Primary distribution is of the radial type with secondary ties.

LIST OF PRINCIPAL EQUIPMENT FOR FILER CITY POWER PLANT

Boiler	Babcock & Wilcox Co
Superheater inverted drainable loop type	Babcock & Wilcox Co
Air Preheater	Babcock & Wilcox Co
Burners	Babcock & Wilcox Co
Pulverizers	Babcock & Wilcox Co
Soot Blowers	Diamond Power Specialty Corp
Safety Valves	Manning, Maxwell & Moore, Inc
Blowoff Valves	Edward Valves, Inc
Feed Valves	Edward Valves, Inc
Water Column	Diamond Power Specialty Corp
Coal Conveyer	Fairfield Engineering Co
Ash Handling	United Conveyor Corp
Boiler Feedwater Regulator	Northern Equipment Co
Combustion Control	Hagan Corp
Instrumentation	Republic Flow Meters Co
FD and ID Fans	American Blower Co
Coal Scales	Stock Equipment Co
Boiler Feed Water	Permutit Co
Continuous Blowdown	Permutit Co
Boiler Feedwater Pumps	Worthington Pump & Machinery Corp
Boiler Feedwater Pump Drives	General Electric Co
Forwarding & Booster Pumps	Manistee Iron Works Co
Turbine Generator	General Electric Co
Surface Condenser	C. H. Wheeler Mfg. Co
Pressure Reducing and Desuperheating Stations	Republic Flow Meters Co
Pressure Reducing Stations	Swartwout Co
Condensate Pumps	Ingersoll-Rand Co
Circulating Water Pumps	Ingersoll-Rand Co
Switchgear and Substations	General Electric Co
Condensate Return Pumps	Allis-Chalmers Mfg. Co
Plant Steam Distribution Control	Republic Flow Meters Co
Switchgear Connections	Turner Electric Co

INDUSTRIAL DRINKING WATER SYSTEMS, THEIR BASIC DESIGN AND INSTALLATION

Analysis of the importance of cool drinking water in industry, a description of the general types and methods employed and the practical approach for the proper design are contained in this article. The various tables and graphs are explained with a design problem

ROBERT K. COLLIER,
Mechanical Engineer

COOL DRINKING water can go a long way toward improving industrial personnel efficiency and satisfaction. This is especially true during summer months in most industries and all year-round in those industries where working atmosphere is hot and humid. Since data and calculation methods for drinking water systems have not been widely publicized, most selection methods used are somewhat approximate. Data presented here have been found accurate for all ordinary industrial drinking water systems.

Drinking water cooling for industrial application can be accomplished in one of two ways: (1) central cooling system, and (2) unit coolers. A central cooling system, Fig. 1, consists of a refrigerating machine and a tank fitted with an evaporator coil through which refrigerant passes. Drinking water is fed to the tank from the city main, cooled and pumped to bubblers on upper floors when city pressure is insufficient. Where large quantities of water are to be cooled an agitator is fitted to the tank, and rapid circulation insures effective cooling at all times.

Unit coolers, Fig. 2, have a small refrigerating machine mounted below the fountain and the water is cooled as needed. Two pipe and one electrical connections are required for this type cooler. Refrigerating machine operation is entirely automatic, resembling household type units in construction, appearance and control.

System Advantages

There are no general rules that indicate the method to be installed in any given industrial plant. Both systems have advantages. Central type cooling is often economical when the drinking water system is extensive or when process water is cooled. An example of the latter condition occurs in plants where cold water is needed for bottling operations. Central coolers usually require a pump for pressure at the upper floors and bubbler feed. Figs. 3 and 4 show several common piping arrangements employed with a central system.

Unit coolers have found wide application in offices, drafting rooms, shipping and like spaces, although they have also been installed in manufacturing areas. They require less refrigeration for a given quantity of water and shorter piping runs. Mechanical and electrical maintenance tends to be slightly greater than for central types because there are a larger number of motors, compressors and belts. Where many units must be installed, equipment costs will usually be about the same as for a central system.

Dual requirements for drinking and process water generally indicate central cooling. Initial and operating costs will be less than for separate drinking and process water systems. The unit type of serving only a few persons is lower in cost. For moderate and large drinking water demands, cost comparisons are necessary to determine the most economical method.

In the central cooling system, as well as in the unit system, heat must be removed from water that is wasted by

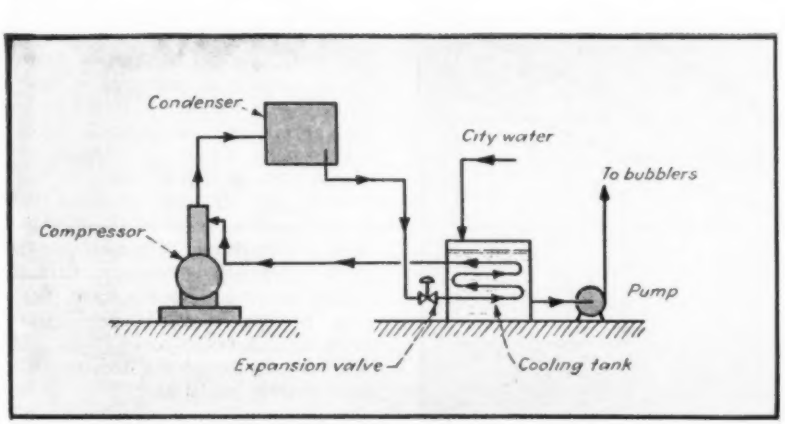


Fig. 1—Where chilled water is employed for plant processing, only a small additional investment is required for equipment to supply cheap cool drinking water

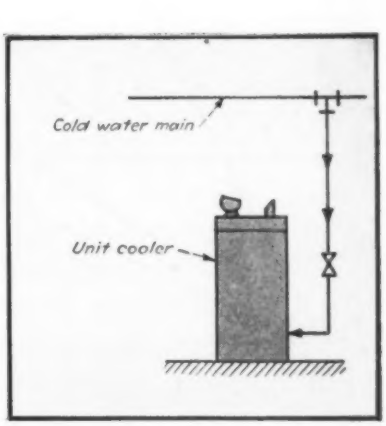
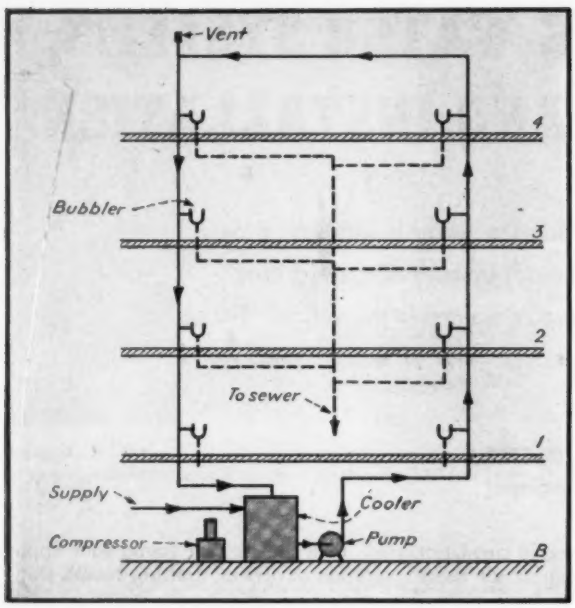


Fig. 2—Unit coolers are ideal for either small or large industrial plants



Central cooling system piping layout offers many varied combinations. Fig. 3 (left) has bubblers on both risers, while

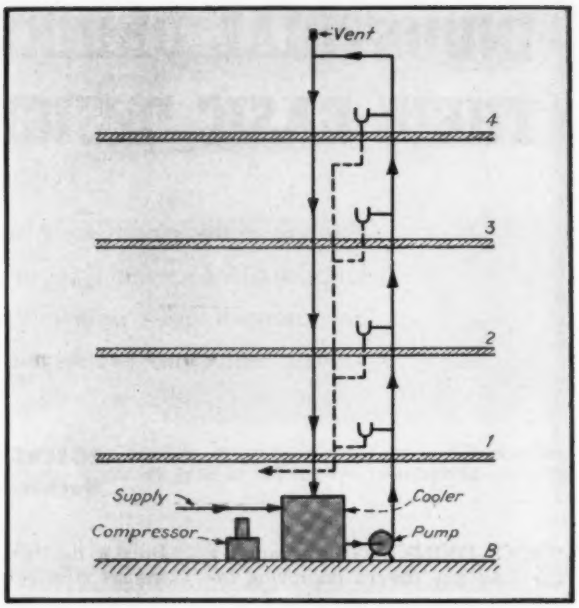


Fig. 4 (right) has bubblers on one riser. To obtain results cool water should be constantly circulated in the system

personnel. In addition an allowance must be made for removal of heat gained in the water risers. Unit coolers do not require this safety factor as there is no appreciable gain between the coil and the water spout.

Water Requirements

Table 1 shows average water consumption per individual per 8 hour day for various classes of industrial work. Heat gains in terms of gallons of water per hour for risers in central cooling systems are given in Table 2. Refrigeration tonnage when total hourly water consumption and temperature reduction are known can be found in the chart (Fig. 6).

These data can best be explained in a simple problem. For example an industrial plant doing light work employs a maximum of 1500 persons. How much refrigeration is required for central and unit coolers when water enters the plant at 80 F, indoor temperature is 70 F, and 500 ft of piping is used with the central cooler?

Solution: Water consumption for light work is 1.2 gal per 8 hr per person, from Table 1. Daily consumption for 1500 persons is 1800 gal.

Medical research advocates that drinking water should not be more than 30 F below room temperature. Assuming a value of 25 F, water temperature will be 70-25 or 45 F. Water temperature reduction is therefore 80-45 or 35 F. From Fig. 5, for a 25 F difference between water and room air temperature, heat gain in terms of gallons of water is 6.75 gph per 500 ft of pipe, and for an 8 hour day, 54 gal. Hence, total daily consumption for a system with a central cooler is 1800 plus or 1854 gal, which is 232 gph. From Fig. 6, tonnage required is 5.65.

For unit coolers only 1800 gal per day or 225 gal per hr must be cooled because there is no heat gain in risers. From Fig. 6 tonnage is found to be 5.47 tons. This capacity would be divided among coolers as required by relative consumption at each.

Piping between water main and unit coolers requires no special planning because a valved run of proper size is all that is usually necessary. Central coolers, however, deserve some planning because excessive heat gains might occur between cooling tank and bubblers even though the lines are well covered with insulation.

As shown in Figs. 3 and 4, any piping arrangements are possible with central coolers. Non-circulating upfeed or

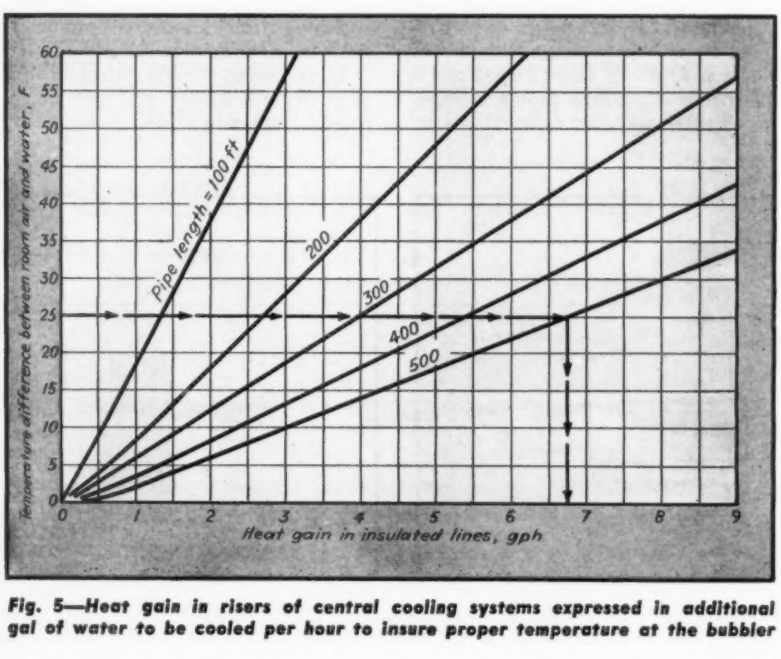


Fig. 5—Heat gain in risers of central cooling systems expressed in additional gal of water to be cooled per hour to insure proper temperature at the bubbler

downfeed systems are suitable where city or plant water pressure is sufficient and drinking water demand is fairly continuous on all floors. Where demand fluctuates considerably or in plants where intermediate floors are frequently unoccupied, non-circulating systems are undesirable.

Infrequent Service

The water, when not frequently used, absorbs heat in the pipe and is wasted to the sewer by personnel. A circulating system, Fig 3 or 4, requires more pipe but insures immediate flow of cool water. Less water is wasted when this piping arrangement is installed. Bubblers can be connected to either the upfeed or downfeed risers, if necessary.

Either a separate cooling water waste line can be used or bubbler drains can be connected to the common plant waste line. Only where drinking water consumption is large need waste line size be increased.

Cork or hair felt is usually employed for insulation of cold water piping. When not subjected to freezing temperatures, the thicknesses listed in Table 2 are satisfactory. For freezing temperatures, such as when the pipes are run outdoors, three 1 in. thick layers of hair felt are frequently recommended for insulation.

Prevents Sweating

Besides lowering heat gain, insulation prevents "sweating", a condition which may be particularly harmful to certain manufacturing operations. An adequately thick insulation will be dry at all normal humidities encountered during plant operation and will not permit excessive temperature rise of cooled water in the system.

Central cooling systems with recirculating risers are generally fitted with a centrifugal pump to produce required flow through the system. Operation is continuous to insure cool water at the bubbler as soon as the valve is opened.

Pump head is equal to the vertical distance between pump and highest bubbler plus friction in the discharge piping, fittings and pressure needed at highest bubbler. Minimum city water pressure is subtracted from this sum.

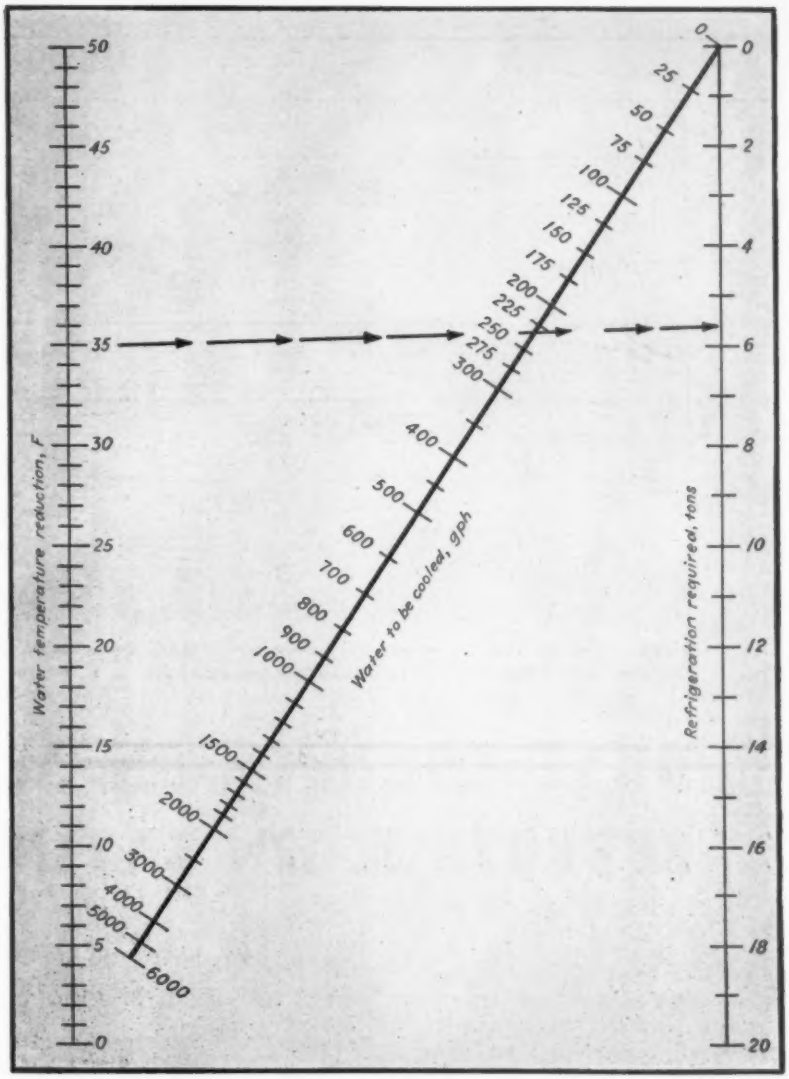


Fig. 6—Refrigeration capacity to cool water. Locate water temperature reduction (left), draw line through quantity to be cooled and read tonnage necessary (right)

Pump capacity should equal the plant consumption of water per hour.

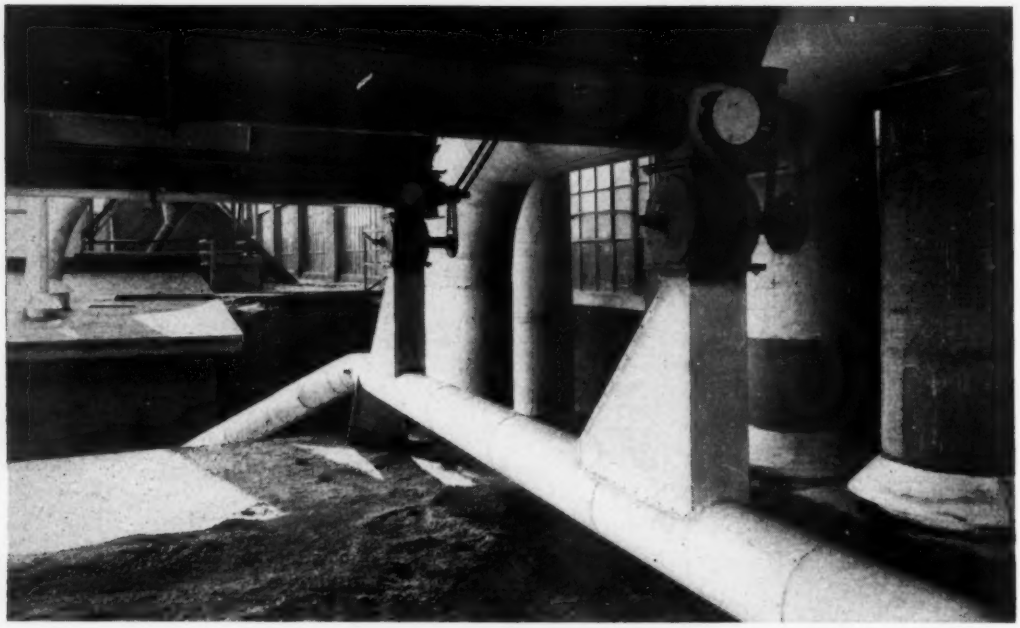
A dangerous, hot, or extremely cold location for a bubbler will nullify the advantages of the system. In general, bubbler location on a wall or column away from production machinery, hot pipes, and other equipment which might be injurious is best. A distance of 275 to 300 ft is generally the maximum allowable. Where large groups of employes are concentrated on one or more floors, a distance of 50 to 75 ft is considered good practice.

TABLE 1—DAILY DRINKING WATER CONSUMPTION IN VARIOUS INDUSTRIES PER PERSON

Working conditions	Gal used and wasted per 8 hr day
Offices, drafting rooms	1.0
Factories, light work	1.2
Factories, heavy work	1.6
Foundries and steel mills	2.4

TABLE 2—INSULATION THICKNESS FOR PIPES NOT SUBJECTED TO FREEZING TEMPERATURES

Room relative humidity, per cent	Thickness, inches per temperature difference		
	50F	60F	70F
80 to 85	2	2½	3
70 to 80	1½	2	2
70 and less	1	1	1½



Screw conveyor, located under dust collector hopper, continuously feeds the rotary valve leading to boiler supply duct. These rotary valves act as an air lock to prevent equalization of the pressures

DUST COLLECTION ALTERATION EFFECTS A 33% SAVING IN HEAT

This company has made use of sawdust heating value to lower the cost of fuel. Cloth filter dust collectors were installed, and the collection system revamped to reduce maintenance problems, improve community relations, better work conditions and overall efficiency

DONALD E. BEHRENS, ***Director of Research***

AT the Grand Rapids Store Equipment Company, a changeover from cyclone to cloth filter type collectors has reduced heating costs approximately $6,000.00 per year. These and other savings have come about from applying an unusual sales policy to their own production problems. Although this company manufactures show cases, counters, and other display equipment, its sales structure is based on selling through creative planning. Ideas are sold rather than equipment, and retail stores are shown how rearrangement and modernization will help improve their selling efficiency and operating economy.

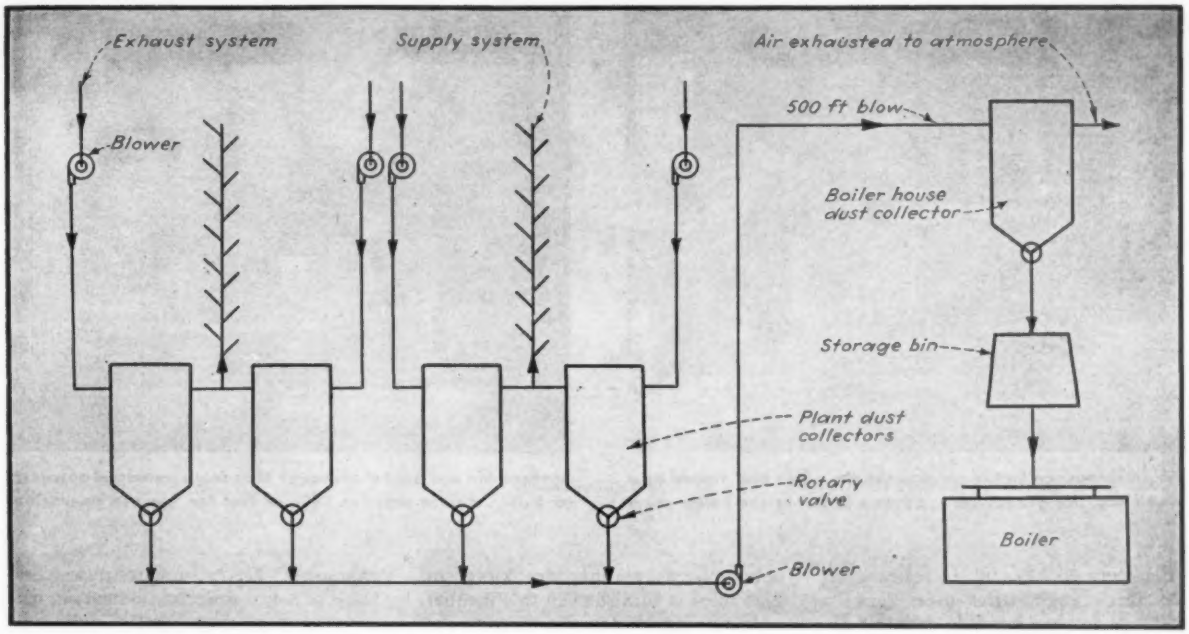
Applying this same progressive thinking to their own production facilities, this company each year examines equipment and plant layout in an effort to maintain top production efficiency. An extensive survey has been made in an effort to eliminate lost motion wherever possible and to increase production efficiency. During the survey, the dust collection system came in for much deserved criticism from both inside and outside the plant.

Before the changeover, dust collection equipment consisted of cyclone collectors mounted on the roof. In order to remove all dust created by various woodworking operations, these collectors exhausted 70,000 cfm. As the air was not sufficiently cleaned in the cyclones, it could not be returned to the plant. This air was released through vents in the collector, and a certain amount of sawdust escaped with it.

With 70,000 cfm exhausted from the plant outside air replacement was necessary. In the wintertime, unheated air poured in through windows and endangered workers' health. Therefore, window heaters were necessary to temper the air as it entered the plant. Naturally, heating costs increased.

There were other disadvantages as well. The volume of air entering through the window heaters was limited and did not offset the air being exhausted. Thus a low pressure was created that loosened putty and increased window maintenance. Furthermore, employes opening doors often would lose their grip on the handle, and the door would slam with a shocking noise distracting other workers.

Officials of the company studied all available dust collecting equipment before selecting a cloth filter tube collector. This unit filters the air and permits its return to the plant with only the minimum of heat loss.



One line flow diagram of dust collecting system that picks up waste from saws, sanders, planers and other wood working equipment. Dust laden air is filtered in cloth collectors and returned to the shop areas to reduce heating load

In all five collectors were installed. Four are mounted just outside the first floor, as more than 90% of the dust is created by the first floor operation. This change in location eliminated a large amount of piping previously needed to convey the dust.

The fifth collector is mounted on the boiler room roof and collects dust discharged by the other collectors. From this point the dust drops into a storage bin to supply the boiler's fuel.

Changeover from cyclone to cloth filter collectors has proved to be surprisingly profitable and has resulted in four important advantages:

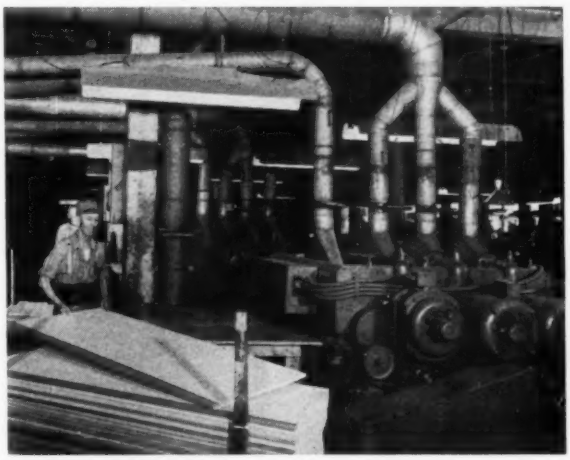
1. Because the new collectors filter the air so thoroughly, the same air can be returned to the plant. This air does not have to be reheated as the amount of heat loss is small. So far the number of window heaters that can be eliminated has not been determined, as the system has not completed a full winter operation. However, a saving of 33% in fuel consumption has been estimated. A complete study to determine accurate cost saving is planned.

2. Plant maintenance has been reduced considerably. With air pressure balanced there is little or no damage to the windows and building.

3. Community relations have improved and all complaints have stopped as dust is no longer exhausted into the surrounding atmosphere.

4. Working conditions and production efficiency have been improved, and rearrangement of production machinery provides a better flow of work.

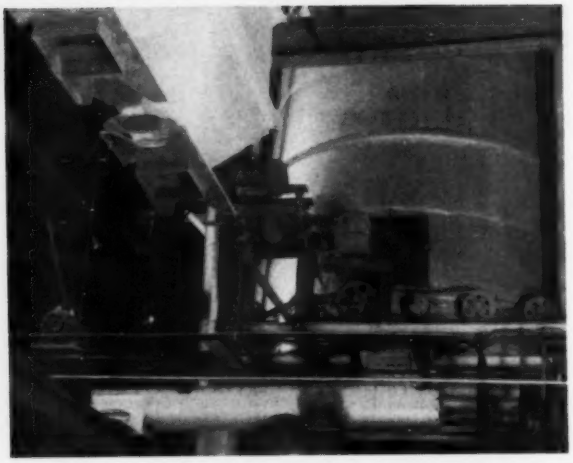
A network of piping carries the dust from each woodworking operation. Double surfacing drum sanders and other equipment are hooded to carry away sawdust particles. Smaller pipes from machines carry dust into one of four major suction lines. Each major line has a large blower capable of



Double surfacing drum sander has four hoods to trap dust at the source. Cleanliness of shop indicates system efficiency

Exhaust ducts connecting production equipment and cloth collector are circular, while air supply ducts are rectangular

Wood scraps, collected throughout the plant and hauled to a wood hog, are ground up and blown 500 ft to the boiler room



Storage bin and screw conveyer that feeds salvaged sawdust to boiler. Refuse supplies 95% of fuel for summer operation

exhausting 20,000 cfm. In rearranging the machines, smaller pipe sizes in many cases were possible and this afforded a reduction in air volume. As a result a saving of 70 hp per day was effected in blower operation.

Dust laden air is blown directly into collectors mounted just outside the first floor. Air and dust enter through the side and travel downward into an expansion chamber. Impingement upon baffle plates and sudden reduction in air velocity cause the heavier particles to drop into the hopper below. The air continues through the cloth tubes, is filtered and all remaining dust particles are removed. The clean air is then returned to the plant.

Automatic Shakers

To keep the cleaning units in top working order at all times the tubes are cleaned periodically by shaking. These shaking cycles are automatic and whenever the collector is shut down the tubes are automatically shaken for approximately two and one-half minutes. Two cleaning periods are provided a day; during the noon hour and when the plant closes for the day.

Dust that falls into the hopper is continuously removed by a screw conveyer and rotary valve and carried to another blower. Sawdust, chips and shavings collected from the various woodworking operations are blown through piping to the fifth collector mounted over the boiler room. This unit also collects scrap which is ground up in a wood hog.

Scrap and dust drop directly into a large storage bin located below the collector. Feed to the boilers is made by screw conveyers. Dust and scrap supply a considerable amount of heat for the plant. In the summertime, 95% of the heat needed for such processing operations as plating, dry kilns and glue lines is furnished in this manner.

If nothing else, this installation carries a very important lesson for plant engineers: Never underestimate the value of a dust collection system nor the importance of choosing the right collector to perform the job.

LIST OF PRINCIPAL PNEUMATIC CONVEYING EQUIPMENT

Fans	Waltz-Holst Blow Pipe Co.
Fan Motor	Allis-Chalmers Mfg. Co.
Fan Drives	Allis-Chalmers Mfg. Co.
Dust Collectors	American Wheelabrator & Equipment Corp.
Screw Conveyer	Screw Conveyor Corp.
Rotary Valves	Screw Conveyor Corp.
Rotary Valve Motors	Allis-Chalmers Mfg. Co.
Electrical Controls	Square D Co.
Compensators for Motors	Allis-Chalmers Mfg. Co.
Storage Bins	Waltz-Holst Blow Pipe Co.
Wood Hog	Williams Patented Crusher & Pulverizer Co.
Wood Hog Motor	Allis-Chalmers Mfg. Co.
Wood Hog Conveyer	The Rapids-Standard Co., Inc.
Transmission Chains	Morse Chain Co.
Transmission Gears	The Ohio Gear Co.
Installing Contractor	Waltz-Holst Blow Pipe Co.

Dust collectors are located just outside of the first floor operations where 90% of the dust is created. Collected dust is blown 500 ft to the boiler house unit

ELEVATOR MAINTENANCE CHART

№ 6 FREIGHT

EQUIPMENT	January Week of: 3-7	10-14	17-21	24-28	February Week of: 31-4	7-11	14-18	21-25	March Week of: 28-4	7-11	14-18	21-25	April Week of: 28-1	4-8	11-15	18-22	25-29
Hoist Motor Bearings	T.R.	T.R.	W.B.	R.S.	T.R.	R.S.	R.S.	W.B	T.R.	W.B.	W.B.	W.B					
Gear Unit	T.R.	T.R.	W.B.	R.S.	T.R.	R.S.	R.S.	W.B.	T.R.	W.B.	W.B.	W.B.					
Car Guide Rails	T.R.	W.B.	W.B.														
Cable Idler Sheaves	T.R.	W.B.															
M-G Set Bearings	W.B.	W.B.															
Hoist Motor	W.B.	W.B.															
M-G Set	W.B	W.B															
M-G Set Controller	W.B	R.S.															
Hoist Motor Controller	W.B.	R.S.															
Signal System	W.B.	R.S.															
Control Cables	R.S.	R.S.															
Hoist Cables	R.S.	W.B.															
Hydraulic Buffers	R.S.	W.B.															

Fig. 1—Inspection and work charts for each elevator insure systematic coverage in minimum time. This one is based on daily, heavy-duty service

This kind of planned maintenance will give your elevators a "lift" and keep an important link in your passenger or freight transportation system operating smoothly and safely. Here are methods of treating the important points of wear and failure

THOMAS TRAIL

OUNCE OF PREVENTION FOR ELEVATORS

ELEVATORS differ from other electrically powered equipment in several ways and require a specialized type of maintenance. Usually control apparatus operates more frequently and is subject to more rapid wear. In making level stops, the motor often is started, stopped and reversed with great rapidity. Since motor and control apparatus is generally in an isolated location, there is little likelihood that the development of faults will be observed by anyone between inspections. These factors necessitate a particularly rigid plan of regular inspection and maintenance for safe, uninterrupted service. Such a plan can provide adequate protection with minimum requirement of maintenance time.

Fig. 1 shows a suggested maintenance form, a separate chart (usually in card form) being employed for each elevator. This particular one is based on weekly inspections of each piece of equipment and is recommended for elevators in daily heavy-duty service. Where elevators are operated less frequently, some phases of inspection and maintenance may be extended to longer periods.

Maintenance consists of electrical, mechanical, lubrication and safety factors. The work may be handled either by one mechanic thoroughly familiar with all phases, or by separate mechanics, each responsible for one phase.

To systematize the work, it is well to take each elevator out of service at a slack period and give it a test operation, noting any indications of unsatisfactory operation and checking condition of the car and its equipment. See that all mechanical parts are secure, operate smoothly and are not excessively worn. Carry a small oiler and grease gun (if required) and lubricate wherever necessary.

Inspect, clean, lubricate and adjust the car controller, operating switches and other electrical or mechanical equipment, in, on, or under the car, including the car gate or doors. Sandpaper burned contact surfaces. Deposits of grease, oil or oily dust are to be removed with a cloth moistened with carbon tetrachloride. Excessively worn contacts, contact holders, springs and other operating parts should be replaced.

Each shaftway door or gate must function properly both mechanically and electrically. Safety switches should open and close at the proper point of door travel, and mechanical interlocks and latches must operate properly. Any unauthorized means to bypass these safety devices or render them inoperative should be removed. Examine door guides for breakage and loose or missing parts as such defects can be extremely hazardous. Without restraining guides, a door may swing into the

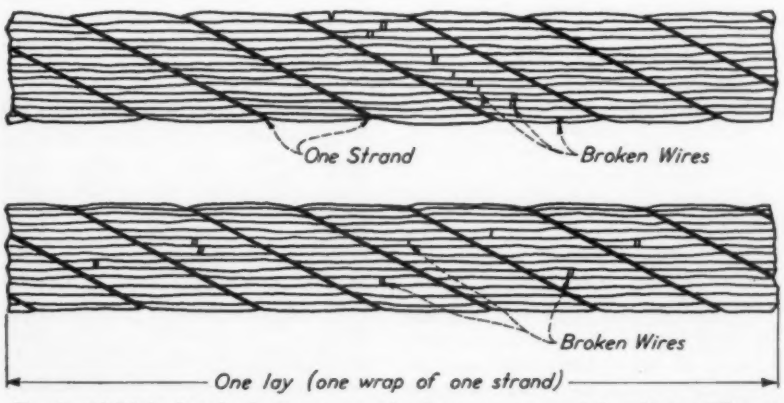


Fig. 2—Multiple breaks in same strand, above, or several breaks in different strands, below, generally warrant renewal. Consult experts for maximum permitted

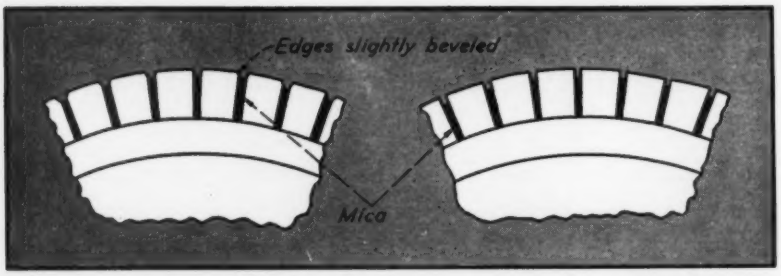


Fig. 4—V-slot undercut for commutators, left, is more self-cleaning than U-slot, right, especially at slower speeds. Remove chips and dust with low-pressure air

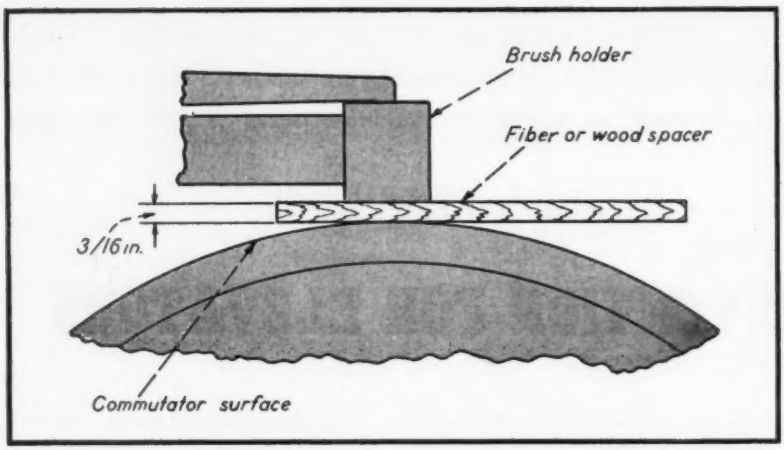


Fig. 5—Use gage approximately 3/16 in. thick to set brush holders to a uniform distance from the commutator surface. Stagger brushes so they do not all track

shaftway and cause a serious accident.

Traveling electrical control and signal cables may be visually checked, preferably from the top of the car while it is operated by a helper. Great care must be exercised to prevent chance of misunderstanding and accident. Cable covers and insulation should be examined, and worn or damaged places repaired with friction or other suitable tape. If worn places are caused by shaftway projections, remove or cover the offenders. If strands of the wires have become excessively worn or damaged, the cable should be cut, damaged portion removed and the cable spliced, care being taken not to leave an inflexible section which may fatigue the adjoining wire strands.

Hoisting, governor, compensating, operating or other mechanical cables must be examined by stopping the car every few feet so that each section can be checked carefully. Where the cables are not greasy or gummy, wiping with thin gloves or cloth usually finds broken wires, since the wire ends snag the cloth. The maximum number of breaks showing in a one-foot section of cable ordinarily is taken as a guide to cable condition.

Authorities' opinions vary somewhat as to how many wire breaks constitute a hazardous condition; but where multiple breaks occur in wires of the same cable strand, or several breaks occur in different strands, Fig. 2, cables generally should be renewed. However, the insurance, state or city elevator inspector should be consulted and where these sources are unavailable, a reliable elevator maintenance company or a cable manufacturer can be contacted.

Guide rail lubricators should be checked for rate of feed and for lubricant reserve. Rails, counterweights, frames and other shaftway equipment or hardware should be examined for looseness or other defects.

Examine all auxiliary hoisting or counterweight sheaves for indications of defects and for lubrication. If possible, ascertain whether bearings are receiving a proper quantity of lubricant and are not overheating.

Governor and governor tension sheaves also should be checked for lubrication and operating condition. Because of their relatively high speed and manner of lubrication, they must be carefully watched to avoid excessive wear of shafts or bearings that would necessitate replacement.

Car and counterweight buffers should be checked for freedom of movement and, if hydraulic in operation, for proper liquid level. Only fluid made for elevator buffers should be used for replenishment.

Elevator control panels are next on the list. Each relay and contactor should be examined for worn or burned contacts, loose or worn parts, broken shunts, defective springs and damaged operating coils.

Excessively worn contactor parts, as well as springs that have lost tension, should be replaced. But be sure that the new parts operate smoothly and in alignment. Sometimes slight alterations may be necessary to make a new part function correctly. Replacement springs must be those recommended by the manufacturer or exact duplicates.

Install new contacts when old ones show excessive wear. If still serviceable and merely burned, file contacts until a new metal surface is presented over their full area and they match them in pairs, as in Fig. 3.

Silver contacts do not require filing unless a projection forms and prevents contact over the entire area. Silver, even though showing a burned appearance, will still give good contact because the oxide is a good electrical conductor.

Carbon to carbon contacts should be sandpapered, if necessary, but not filed. With carbon to metal contacts, smooth the metal with a file or sandpaper, then sandpaper the carbon until a good contact surface is obtained.

Contactor shunts should be replaced when approximately 1/3 of their strands have broken. Sometimes breaks occur inside the terminal ends or the strands loosen in the terminal and it is advisable to test their condition by pulling on the strands at each end.

In checking operating coils, look for indications of overheating or burning. The coil must have adequate pull to close the contactor fully and positively. Especially in the case of a-c relays and contactors, check to see that dirt or other obstruction does not prevent them from closing completely as this will

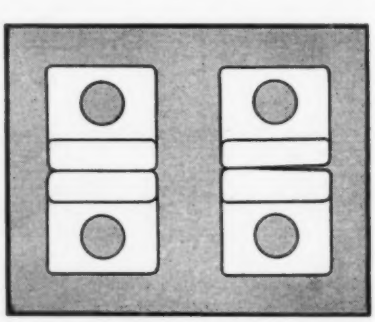


Fig. 3—Properly filed and set, left, contacts meet over entire contact area

cause the coil to overheat and possibly burn out.

Coils that show evidence of having become overheated, burned or otherwise seriously damaged should be replaced.

When relay contacts are smoothed or replaced, it is usually necessary to readjust them to compensate for altered contact thickness. It is advisable to note the distances between fixed and movable parts before starting in order to have a guide when re-adjusting the relay setting. Test interlock contacts to see that they open and close as intended, because wear of parts may render them inoperative.

Hoist motor, m-g set motor and generator (if used), should be examined at windings, leads, commutators and brushes. See that winding and lead insulation is not damaged or affected by oil or grease, and that the coils are held firmly in position. Sometimes d-c motor field coils become loose and require tightening and possibly shimming in addition.

On d-c motors and generator, condition of commutator and brushes is of extreme importance. The commutator must be kept concentric and smooth, especially where higher speeds prevail. A rough or out-of-round commutator should be checked for tightness of bars and then turned until smooth, either in a lathe or by means of a lathe carriage type grinder clamped to the machine.

Mica must be kept well below the surface of bars on undercut commutators as in Fig. 4. Mica slivers which appear near the surface of bars worn to mica level can be removed with a hacksaw blade, ground to conform to the shape of the commutator slots.

Commutators worn sufficiently to become grooved, or to bring the mica too near the surface, should be re-trued, as previously explained. Afterwards the mica should be re-undercut, with a power-driven portable undercutter, specially shaped file or hacksaw blade ground to shape for the purpose.

It is well to protect the armature surface beyond each end of the commutator with friction tape which should be removed afterwards. All dust and metal chips must be blown out of the armature winding with low pressure compressed air, directing the air stream so as to avoid driving the chips into the the winding.

Replace brushes before they are worn sufficiently to prevent their contacting the commutator, and use only brushes of the proper replacement grade. Brush holders should be so located that the brushes will cover as much of the commutator as possible and not all track one another and cut grooves. They should be so arranged that when brushes must track, they are of opposite polarity to prevent uneven wear from selective commutation.

Where commutators are not undercut, the same procedure of re-truing is necessary whenever the surface becomes detrimental to satisfactory commutation. The proper grade of abrasive brushes must be employed to keep the mica flush with the surface.

In setting brush holders, adjust the bottom of each one approximate, but uniform 3/16 in. from the commutator surface, as shown in Fig. 5. Brush-spring pressure should provide from 1¾ to 2½ psi for the contact area.

Maintain lubricant level in oil wells of all rotating electrical equipment having sleeve bearings, making certain oil rings or chains are functioning properly. Generally where bearings are grease or wick lubricated, lubricant inspection need only be made at 3 to 6-month intervals depending upon severity of service.

Brake mechanism should be inspected for proper operation and frictional points lubricated. Also see that open and closed position clearances are satisfactory, and that lining is in good condition and tight on the shoes.

On geared machines, check lubricant level and see that it is circulating properly over the gears and any bearings lubricated by it. Only sufficient lubricant should be permitted to escape from the shaft packing to provide packing lubrication. Also check for excessive end movement of the drive shaft, indicating need for adjustment or replacement of the thrust bearing on the machine.

Aside from the program of weekly (or longer) maintenance, certain other procedures are necessary at proportionately longer intervals. Drain, flush and refill bearings and gear cases in accordance with the manufacturer's recommendations (usually once a year). Test the brake and operation of the elevator under proper test weight load, and test and set the governor by means of a speed test.

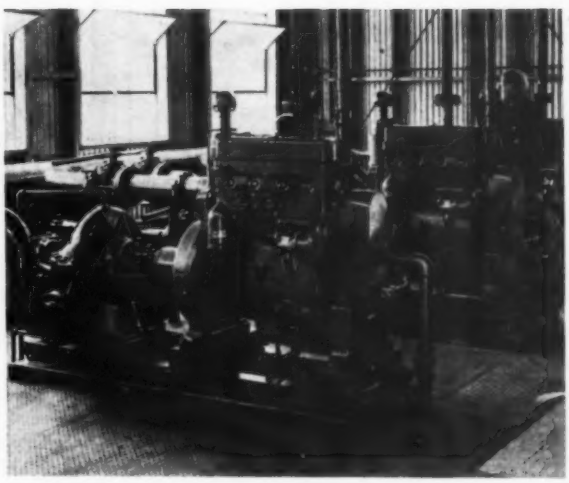
Great care is absolutely necessary at all times to prevent accidents when working on or inspecting elevators. Whenever possible, disconnect power before working on equipment.

Natural Gas Drives Jacket-Water Pumps Economically

Internal combustion engines using natural gas as a fuel have recently been installed by the Brea Cannon Oil Co. in its plant near the city of Fullerton, Calif. Three International type U-9 power units are to be used to pump cooling water to the jackets of two 300-hp Clark engines. These in turn provide the driving power to operate vacuum pumps on the company's gas lines.

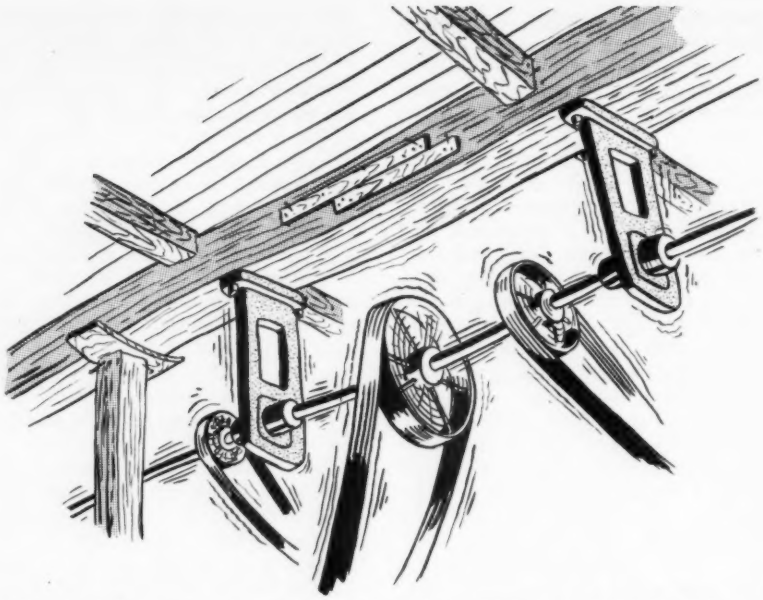
Each of the power units for the jacket-water pumps operates a Fairbanks-Morse pump with 8-in. suction and 6-in. discharge pressures. The photograph shows the three units lined-up at one end of the building housing the engines. One unit is used for standby service, permitting maintenance and repairs without interruption of the flow of cooling water.

The power units have individual air-operated starters. Conventional radiators are conspicuous by their absence in the photograph for, in this case, cooling water is provided by a special system which diverts it from the main line. The Brea Cannon Oil Co. is primarily a producer of crude oil and casing-head gasoline. Courtesy of the Industrial Power Div., International Harvester Co.



WHAT PRICE IGNORANCE, LAZINESS, INEPTNESS

C. T. BAKER,
Consulting Engineer



Building roof trusses were not rigid enough to support the line shafting and keep it true. Result was wobble and increased friction with high power loss

RECENTLY I had occasion to review some engineering reports made as a result of many plant investigations, some dating back as far as 1920. They may prove interesting and helpful to others, because I still find plants making the same mistakes and following the same methods. This, too, in spite of the excellent technical and engineering magazines available to engineers and managers.

It is most difficult to understand the reasons for this continued waste of expensive energy in the form of fuel, steam, electricity and water after so much effort has been expended by so many agencies to raise the operating efficiency of industrial plants.

Basically, I believe most of the causes of such neglect can be laid to ignorance, laziness and indifference as well as to the activities of a large group of people who know a lot of things about engineering that "ain't so." The following case histories will show why.

The management of a stove and range factory complained about the size of the monthly power bill. Blame was placed on the power company's meter. A check with a standard test meter showed the meter to be correct.

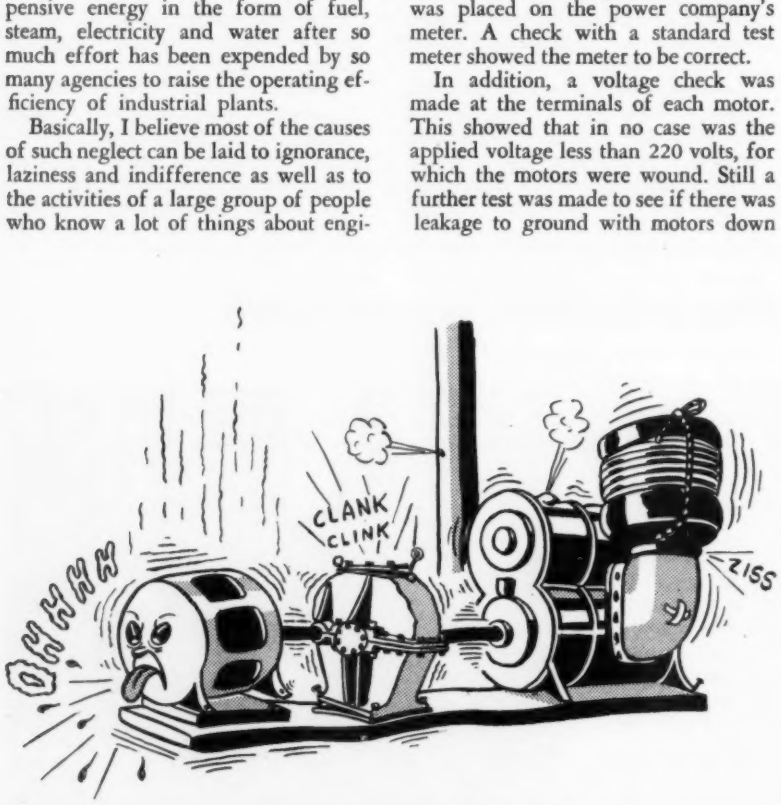
In addition, a voltage check was made at the terminals of each motor. This showed that in no case was the applied voltage less than 220 volts, for which the motors were wound. Still a further test was made to see if there was leakage to ground with motors down and lights out. This would, of course, have been reflected in meter creep, but a negative result was obtained.

Friction Load. Input measurements were made to all motors when operating loaded and when carrying friction load only, to determine what per cent of the total load was represented by friction of line shafting and belts. This developed some interesting facts. It showed that the friction load ranged from 50 to 84% of the total motor load. Checking further, it was discovered that the principal cause of high friction could be laid to the line shafting, which was out of alignment.

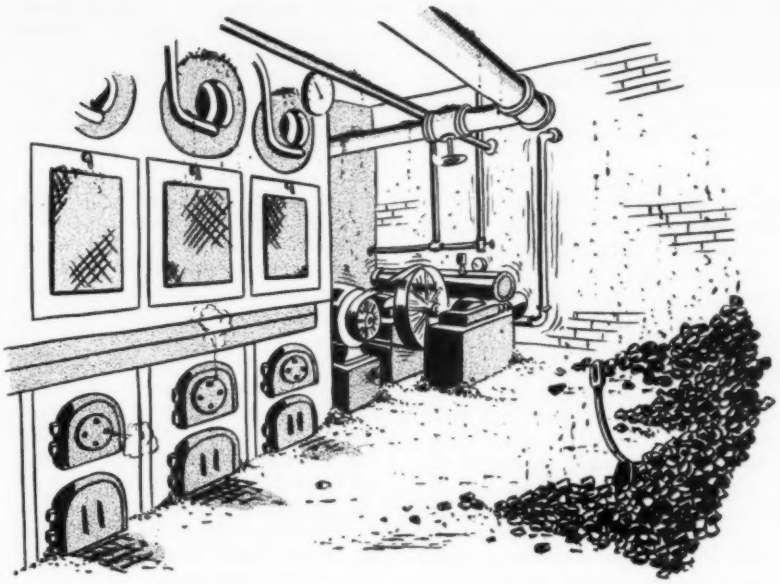
For example: In one department 120 ft of line shafting was supported on drop hangers which, in turn, were supported on wooden roof trusses that spanned the building. These trusses did not afford a rigid support for the shafting and, therefore, it had settled in places and was out of alignment.

Still another condition that added materially to the friction load was the condition of several shaft couplings. After being pressed on the shaft sections, the coupling faces were not true and did not lie in a plane at right angles to the shaft. This resulted in an eccentric motion of the coupling which, in turn, caused the ends of the two sections of shafting to wobble so much in some instances, as to transmit the movement to the adjacent drop hangers.

I also found that a 50-hp motor driving a large air blower supplying air to the cupolas had a very high friction load. The shaft was sprung, the gears noisy and vibration excessive. A



Bent shaft in a blower increased its running friction, made the gears noisy and caused the machine to vibrate. A new shaft and complete overhaul was needed



Air compressor installed in a boiler room got the full effect of coal and ash dust. Motor windings got it from inside and intake pipe picked up the remainder

complete overhaul was necessary, which included the installation of a new shaft. Tight belts that were badly overloaded was still another cause of excessive friction loss in this plant.

To correct the wasteful, power consuming conditions found as a result of this investigation, a competent millwright and machinist were employed to completely overhaul and recondition all power transmission equipment, including shafting, bearings and belts. The greater part of this work had to be done over the weekends, but when finally completed, the average friction load had dropped to only a fraction of the total load, which exonerated the power company from the original complaint.

While it is true the power transmitted by belts and shafting in factories and other institutions has diminished, it is still a fact that there are in operation today, many such drives, including group drives, which, if neglected, will take a heavy toll in power because of high friction loads.

In 1934, with the country in the throes of a financial depression, a call came from the manager of a medium sized dairy to find the reason for his high power costs. Since a refrigerating plant accounted for the major portion of the current used, I looked there first for evidence.

The three refrigerating compressors required a total of 80 hp in motors. The trouble was soon located. The condenser tubes were badly coated with algae, a non-conductor of heat, while the ammonia system contained considerable air. This condition resulted in abnormally high condensing pressures as the following will show:

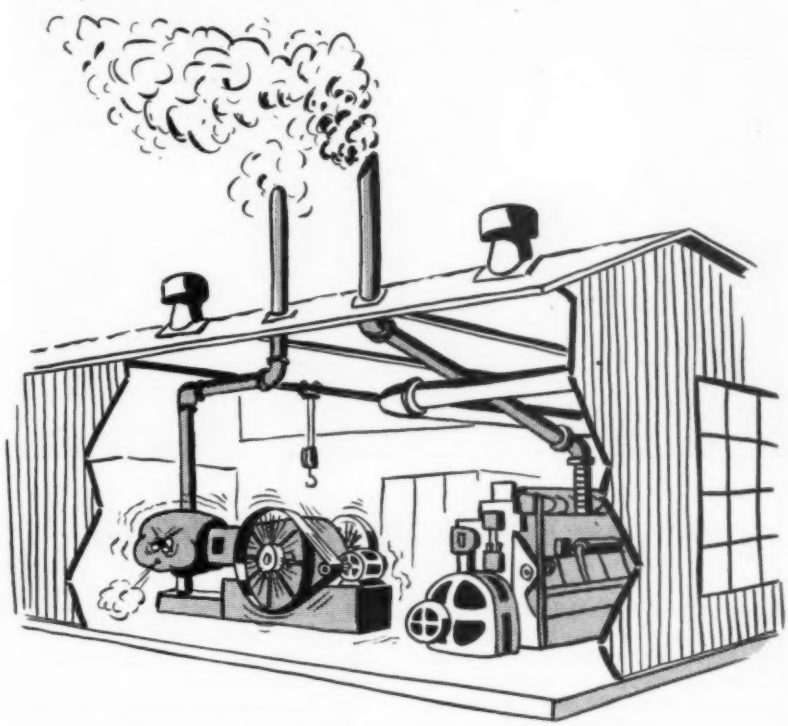
Water on condenser 76 F.
Water off condenser 86 F.
Condensing pressure 235 psig.

After purging the system of air and cleaning the condensers, the condensing pressure was lowered to 170, a reduction of 65 psi. The net result was increased refrigerating tonnage, reduced running time of the compressors and a drop of 21% in power cost.

As previously stated, that was sixteen years ago. During last May, I found almost an identical condition in another refrigerating plant not over fifty miles from the first. Truly, we learn slowly.

During the early 1920's, I investigated an air compressor that had been in service many years. It was a two-stage machine with the usual innercooler between the high- and low-pressure cylinders, and directly connected to a 215-hp synchronous motor. Although both compressor and motor were of a well-known make, each having a record of many years of successful performance behind it, the plant engineer and superintendent both insisted that the unit, as a whole, was incapable of satisfactory performance because, as they expressed it, "the compressor was not built right and the motor did not fit."

Investigations disclosed (1) the compressor motor was overloaded, (2) all suction and discharge valves leaked badly, (3) the low-pressure cylinder was badly scored and had one broken piston ring. The piston and rings, as well as the cylinder were badly worn and the center line of the piston was low, causing excessive rod wear. Friction losses in this cylinder were extreme.



This air compressor was installed in a clean room, but the intake kept company with the diesel exhaust on the roof and breathed in the out-going sulfur fumes

The motor, which had a guaranteed efficiency of 91% at full load, 90.8% at three-quarter load and 89% at one-half load, all based on unity power factor, was found to be operating at 80% power factor, or less, which, of course, lowered its efficiency. This situation was corrected by installing a power factor indicator and instructing the operators how to control the motor field to maintain unity power factor. This was well worth while, as on this particular motor the difference in efficiency between 90% and unity power factor was 2-½ to 3%.

No Intake Filter. In investigating the cause of cut cylinders, leaky valves and other mechanical troubles, not much search was required to find the answer. The intake pipe extended outside the engine room, thence upwards to about the height of the center line of the roof. No filter had been placed on the intake. During a greater part of the time, the air was heavily charged with foreign matter, which damaged the cylinders and valves.

This condition had prevailed ever since the installation was made some years before and, of course, the damage was done. The loss of air capacity and the increased power cost had taken a heavy toll, which could only be charged to ignorance, carelessness and indifference. The compressor had to be taken out of service for a complete overhaul including the reboring of one cylinder.

At the time this machine was installed, the compressed air using equipment, such as drills, hammers, etc. was confined to a radius of about 100 ft from the compressor station. As time went on, the demand for compressed air increased, due to the addition of more shops. This called for more tools, pneumatic hoists, etc. and, of course, for more air lines and more air. Unfortunately, however, no study was made to determine just how much additional air would be required by the sudden expansion of shop facilities, nor was any effort made to determine peak air demands. All that had been done was to extend an originally undersized supply main to the new area of operations.

Pressure loss tests made over the areas in which the various shops were located disclosed a deplorable condition—just how they were able to turn out as much work as they did remains a mystery.

This condition was remedied by installing mains and laterals of sufficient capacity to insure maintaining the required pressure at the tools at all times. Had a little common sense been exercised in the installation and operation of this compressor, there would have been no such tale to tell.

During the second year of World War II a large organization secured a Government contract for certain equipment required by the armed forces.

Since, as a result of the contract, considerable compressed air at 150 psi was required, a compressor meeting the requirements was obtained through WPB who authorized prompt shipment. The boiler room of this manufacturer was rather large. So, after considerable discussion on the question of location, one of the "best minds" in the organization ordered the compressor placed in the boiler room. Here the motor winding received the full benefit of ash and coal dust impregnation.

At the same time, the intake was placed near the coal bin into which coal was dumped direct from cars on a railroad siding. As the intake was not fitted with a filter, it required no stretch of the imagination to predict what eventually happened.

When I visited the plant on one occasion, coal was being unloaded and the air was black with dust—the compressor pulling much of it straight into the low-pressure cylinder. Failure of this machine to deliver rated capacity is not difficult to understand.

A 100-hp two-cylinder Diesel engine furnished electric power for a small manufacturing plant. Some time after the engine was installed, a compressor was purchased to supply compressed air for certain operations. The air intake pipe was extended vertically to a point just above the parapet wall of the building and terminated very close to the exhaust pipe of the oil engine.

During operation, considerable engine exhaust was picked up by the compressor. The oil used by the engine ran fairly high in sulfur content which, when mixed with the moisture of the air, produced the very destructive sulfurous acid.

When such numerous cases of damaged equipment are discovered we might ask ourselves why so many men use such little judgment in matters pertaining to the installation and care of valuable machinery and equipment. And why do those guilty of such practice try to place the blame on machinery manufacturers or other individuals? They are in no way responsible for the acts of others who choose to proceed without benefit of good engineering, and with the confidence of ignorance to assume responsibility for the installation and operation of machinery.

How They Assemble Rotor Poles in the Shop

● Assembly of large synchronous condensers has been simplified at Allis-Chalmers with a track and carriage device that permits moving coils and poles under the rotor. The new method does away with the need for a crane and safeguards against possible coil distortion in handling. Now the coils and poles are moved under the rotor, the pole is inserted into the dovetail slot and the pole and keys are driven into position.

The new arrangement is a suggestion by Thomas Thoresen (right) pointing out how it works to A. A. Ryan, superintendent of the electrical division.

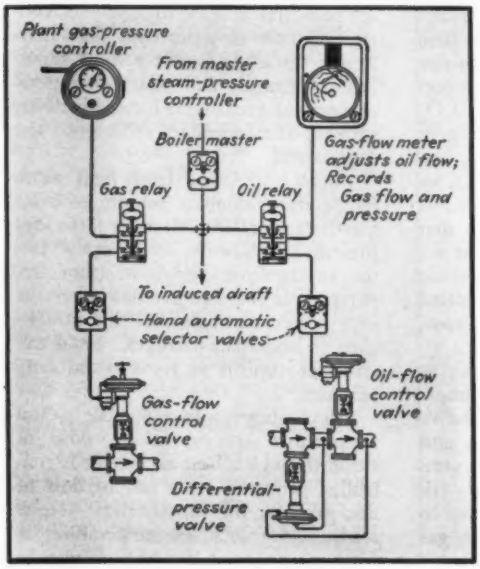


Fig. 1—This dual-fuel control fires gas when available, and enough oil to maintain demand

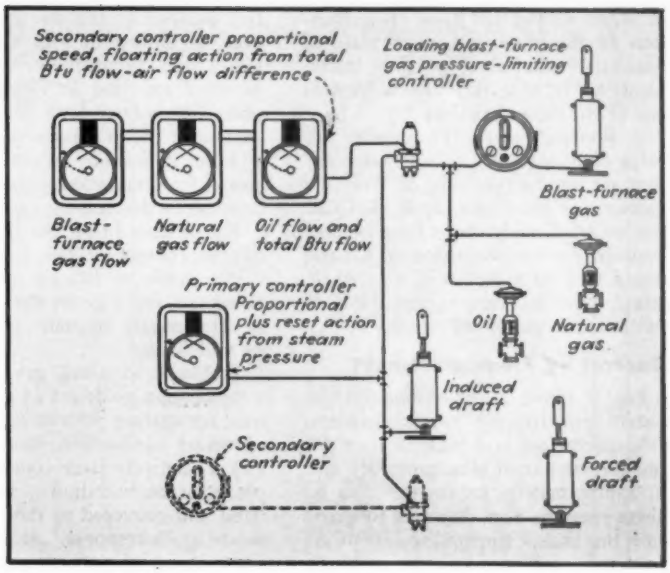

Secondary controller proportional speed, floating action from total Btu flow-air flow difference
Loading blast-furnace gas pressure-limiting controller
Blast-furnace gas flow
Natural gas flow
Oil flow and total Btu flow
Blast-furnace gas
Primary controller Proportional plus reset action from steam pressure
Oil
Natural gas
Induced draft
Secondary controller
Forced draft

Fig. 2—Multiple-fuel controller adjusts combustion-air flow to heat demand, and premeasures available fuels for optimum combustion

TRENDS IN MODERN BOILER CONTROL

Today's problems bring tomorrow's controls. Here are control answers* to (a) multiple fuel firing, (b) higher pressures and temperatures, (c) water level by variable-speed pumps and (d) central control rooms

J. F. LUHRS, *Bailey Meter Company*

MULTIPLE-FUEL FIRING as a result of fluctuations in availability and cost of coal and oil have made fuel burning equipment suitable for handling either fuel, either singly or in combination, desirable. Multiple fuel firing has also been accelerated by increasing supplies of natural gas, frequently obtained only on an "as available" basis.

Where two or more fuels are to be used these arrangements are possible: (a) one fuel may be burned at a time, (b) two or more fuels may be burned simultaneously, or (c) two or more fuels may be burned simultaneously—one as available and enough other to make up the demand.

Fundamental control problems in burning multiple fuels are, as when burning a single fuel, (1) to provide an energy input to the furnace sufficient to maintain steam pressure and (2) to maintain the fuel-air ratio for optimum combustion efficiency.

Requirement (1) is not serious. Shown in Fig. 1 is a fuel control arrangement which will fire gas as available and simultaneously vary oil flow so that heat input is not materially affected by available gas supply. Total fuel rate to the boiler is determined by the master selector valve which transmits an air loading pressure to the first chambers of gas and oil relays.

The gas flow controller establishes an air loading pressure which varies directly with the gas flow and which is introduced into the oil relay to vary the oil flow to the furnace inversely with flow of gas. By proper adjustment, changes in oil flow caused by changes in gas flow can be made to compensate changes in Btu input.

Also, as indicated in Fig. 1, air flow may be varied by the master loading pressure to maintain approximately the correct ratio between total fuel and combustion air.

Requirement (2) will be simplified if it is restated as—to maintain Btu input (in the form of fuel) and air input in that ratio which will give optimum combustion efficiency. The graph in Fig. 3 shows the relation between air required per pound of fuel for various commercial coals and air required per 10,000 Btu liberated from the same coals. While the former ratio varies greatly, the latter remains substantially constant for all coals. Curves for all commercial fuels from natural gas to anthracite coal would show the air required per Btu released is a constant within 5%.

Therefore, the problem becomes one of measuring Btu input to the furnace and supplying air in proportion to that input, regardless of whether one or more fuels are being burned singly or simultaneously. Methods available for determining and controlling the variation between Btu input and combustion air are:

1. *Steam flow-Air flow* has been widely used for 30 years. Steam flow is a measure of total Btu liberated and hence the total Btu input. Comparison

*Abstract from a paper contributed by the Industrial Instruments & Regulators Div. for the Fall Meeting of the ASME.

of steam output and flow of combustion air therefore gives a measure of combustion efficiency. Since instruments are reliable, this scheme remains one of the most desirable.

2. *Premeasurement.* Ordinarily, Btu value of liquid and gas is substantially constant and weight rate of flow is a measure of total Btu input. Reliable and accurate mechanisms have become available for totalizing flow of gas and liquid fuel on a Btu basis, and where return type oil burners are used, to subtract the rate of oil return.

Control by Premeasurement

Fig. 2 shows a combustion control system employing premeasurement. Oil, natural gas and blast furnace gas and air are varied simultaneously and in approximately the correct ratio by steam pressure. Fuel flows are totalized on a Btu basis, compared to rate of air flow and readjusted to give optimum combustion. As shown, auxiliary controllers may shut off blast furnace gas when the supply pressure drops. Forced draft may be readjusted.

Of solid fuels, pulverized coal probably offers the best possibility for premeasured control but pulverizers used today do not maintain an output in accordance with raw coal feed. Even if an accurate means of measuring weight rate of coal flow were available, it could not easily be reduced to Btu input rate because of variations in moisture content, analysis and Btu value. Orifice installations at the forced draft fans measure combustion air.

Gas analysis determines ratio between Btu and air inputs by quantitative analysis of the flue gases. However, as shown in Fig. 4, that ratio varies for different fuels and when two or more are fired in varying proportions, CO_2 content loses all value. CO_2 content of the flue gases may also give a false indication because CO_2 decreases from maximum either for an increasing or descreasing excess air.

Fig. 4 does bring out the fact that oxygen content of flue gas is an accurate guide of Btu-air ratio because excess air for a given oxygen content is substantially constant for all commercial fuels.

Problems in using gas analysis as a combustion guide are (1) the sample used for analysis must be representative of actual combustion conditions and (2) a relatively large continuous sample must be withdrawn, washed, filtered and conveyed to the analyzer to insure quick response. At present, gas analyzers are of greatest apparent value as a supplement to other guides. As the oxygen analyzer determines excess air without measuring flow of combustion air, effort is being expended to adapt it to ordinary plant requirements.

In burning multiple fuels, consideration must also be given to proper air distribution to the several burners.

Higher Pressures

Strength of materials decreases rapidly when normal temperatures are exceeded and close control of steam pressure and temperature becomes necessary. Furthermore, modern plant equipment loses much in efficiency if design conditions are not maintained.

Methods used to regulate steam temperatures consist of dampers controlling flow of gases over the superheater surface, separately fired superheater furnaces, and steam attemperators or heat exchangers located between primary and secondary sections of the superheater.

Control operating from final steam temperature alone is seldom satisfactory because of the relatively large lags present. Ordinarily, the greatest factor causing rapid changes in steam temperature is the flue-gas flow over the superheater elements and this may be used to anticipate changes. Final micrometer control is from steam temperature.

Fig. 5 shows a two element steam-temperature control where flow of steam through a heat exchanger is controlled primarily from rate of flow of flue gas over the superheater. Rate is readjusted from steam temperature. A further refinement also uses changes in steam temperature at the entrance to the secondary superheater.

Boiler Water Level

In plants where one or more boiler feed pumps are used to supply water to a single boiler there has been a trend toward varying pump speed rather than throttling pump discharge. Chief advantages are (1) power savings at partial loads, (2) longer pump life, (3) possible elimination of one valve and/or (4) increased life of control valve if one is installed for low load or emergency use.

Fig. 6 illustrates how three motor-driven boiler-feed pumps furnish water to a single boiler. Three-element feed-

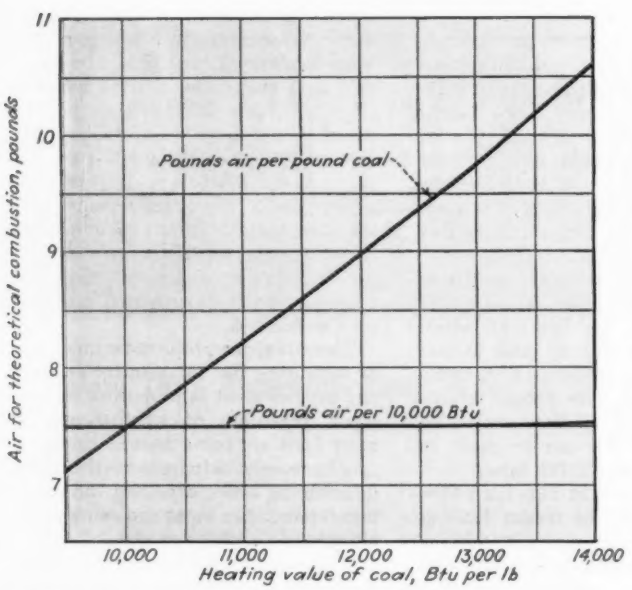


Fig. 3—Combustion air based on Btu content of coal and other fuels is nearly constant and is basis for control in Fig. 2

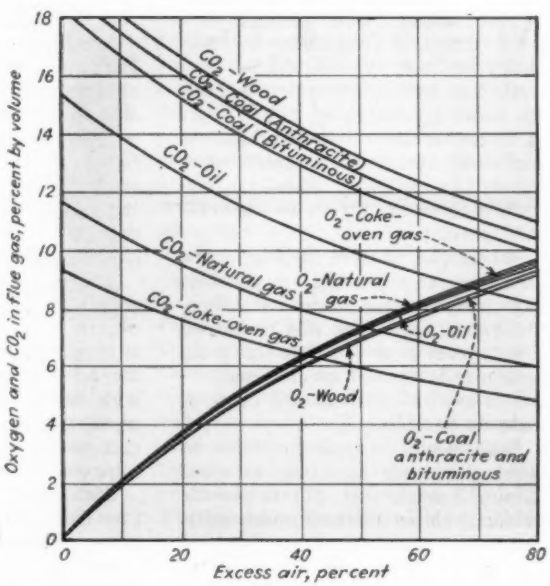


Fig. 4—Oxygen content in flue gas is reliable measure of excess air regardless of fuel. Carbon dioxide is not

water control is used and pump speed is varied by hydraulic couplings to maintain flow of feedwater equal to flow of steam corrected for boiler drum water level.

Porting of the control valve, if used, can be arranged so that when wide open, a negligible pressure drop is produced but, as the valve starts to close, the port area provides sufficient pressure drop for control over normal boiler operating range.

Fig. 6 also illustrates a pump by-pass control wherein, at a minimum discharge determined by the flow indicators, the valves in the pump discharge lines are opened.

Centralized Control Rooms

As reliability of power plant equipment has increased, interest in centralized control rooms has grown. B. C. Mallory has listed some advantages and disadvantages. Advantages are: (1) reduction in number of operators, (2) presentation of all pertinent data to one operator, (3) operator can simultaneously control two or more operations, (4) avoidance of communication errors, (5) they attract a higher type personnel with better judgment, and (6) automatic controls required tend to free the operator from details and permit more supervision.

Disadvantages are: (1) space required for control room in heart of station adds to construction cost, (2) additional equipment to be maintained, (3) complexity of the control room requires long training period for operators, (4) added cost due to duplication of controls, longer runs of leads and the space required, and (5) higher rate of pay for operators.

Length of a main panel to record all factors of a large boiler-turbine unit may be upwards of 30 ft and adequate consideration must be given to grouping, so that a minimum space is occupied by the recorders of those factors necessary for control. Such factors would include, for example, boiler-water level, steam flow, air flow, feedwater flow, and superheated steam temperature. The trend provided by these records is valuable to the operator. Recorders of factors of historical interest, as for gas, air and feedwater temperatures, may well be located on an auxiliary or remotely located panel.

The trend is to avoid high pressure connections to the control room and to telemeter factors such as steam flow, water flow, water level, etc. Under this arrangement, it is possible and desirable to have the automatic control operate directly from the transmitting elements and to provide the control room operator with selector valves for remote manual control, starting-up and emergency conditions.

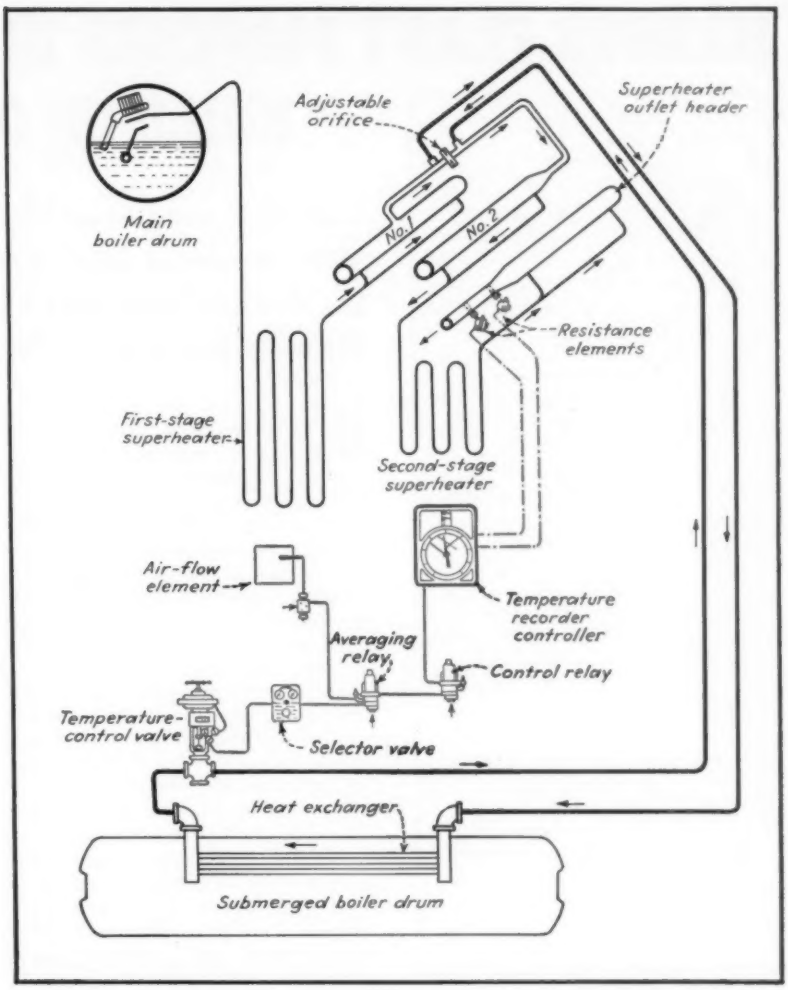


Fig. 5—Two-element steam temperature control anticipates changes by using rate of flue-gas flow over superheater to control flow of steam through heat exchanger

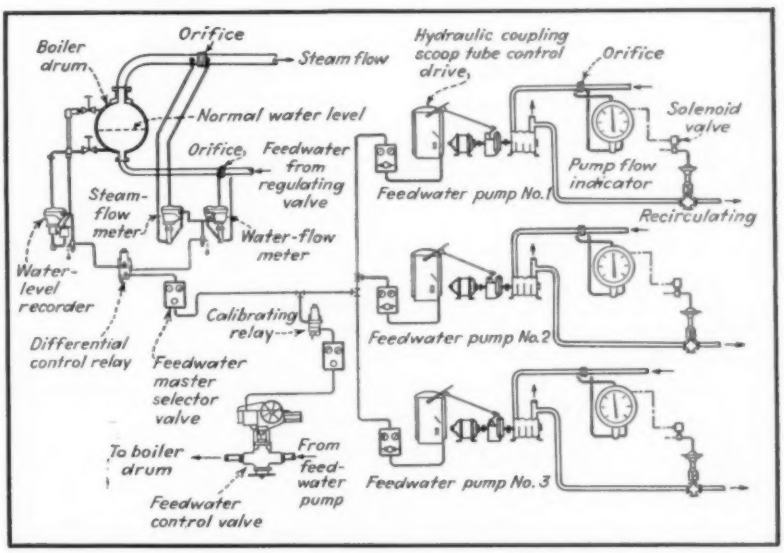


Fig. 6—Present trend is to vary feedwater pump speed. This three-element control uses hydraulic couplings to maintain feedwater flow equal to the flow of steam

HARBOR PLANT PIONEERS IN PNEUMATIC BUILD-UP OF REFRACTORY

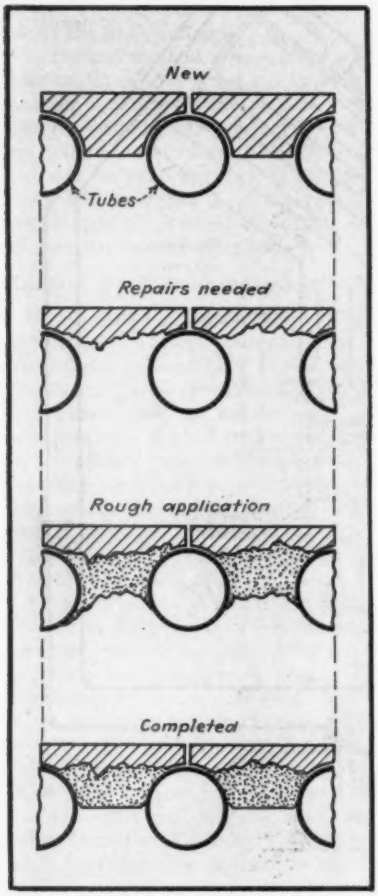


Fig. 1—Scraping to smooth the high spots and clean the tubes finishes job

Experiences, methods and techniques of this large Western Public Utility, in applying boiler refractories with a pneumatic material gun, show that the procedure reduces boiler outage time and saves a surprisingly large amount of the labor ordinarily needed for the job

POWER SHORTAGES created by the phenomenal post-war industrial and domestic expansion on the West Coast reflected upon and seriously reduced the available outage time for normal boiler maintenance and repairs. This condition led to a search for methods that would speed up the application of boiler refractory linings, and thereby reduce the required outage time to a minimum.

Initial problems were the replacement of water-wall tube space refractory filling, Fig. 1, burner cone and panel repairs, Fig. 2, and boiler drum refractory coatings, Fig. 3A.

Due consideration to all pertinent factors involved such as outage time, total cost and end result was given in a study of available techniques, which included reconstruction by means of both temporary and permanent demountable casting forms, plastic linings, special pre-fired shapes, pre-casting and the pneumatic material-gun, commonly used in other engineering fields to build monolithic concrete structures.

Pilot tests of these methods were pursued with strong indications of obtaining superior results by use of the pneumatic material gun. As a result, full-scale repairs were made by this latter method with such marked success that it has been adopted as standard routine procedure. Its superiority has been repeatedly verified.

The pneumatic material machine, operating on compressed air, picks up the dry refractory and suspends it in air, carries it to the point of application through a hose and, at the point of emission from a nozzle, adds enough water for hydraulic set. Leaving the nozzle at high velocity the refractory is directed by the operator to fill voids and form the required contours. The proportions of material-to-water, the shape and depth of coating, etc., are continuously under the operator's control and can be varied instantly at will.

With little experience, the operator can reduce the quantity of water to

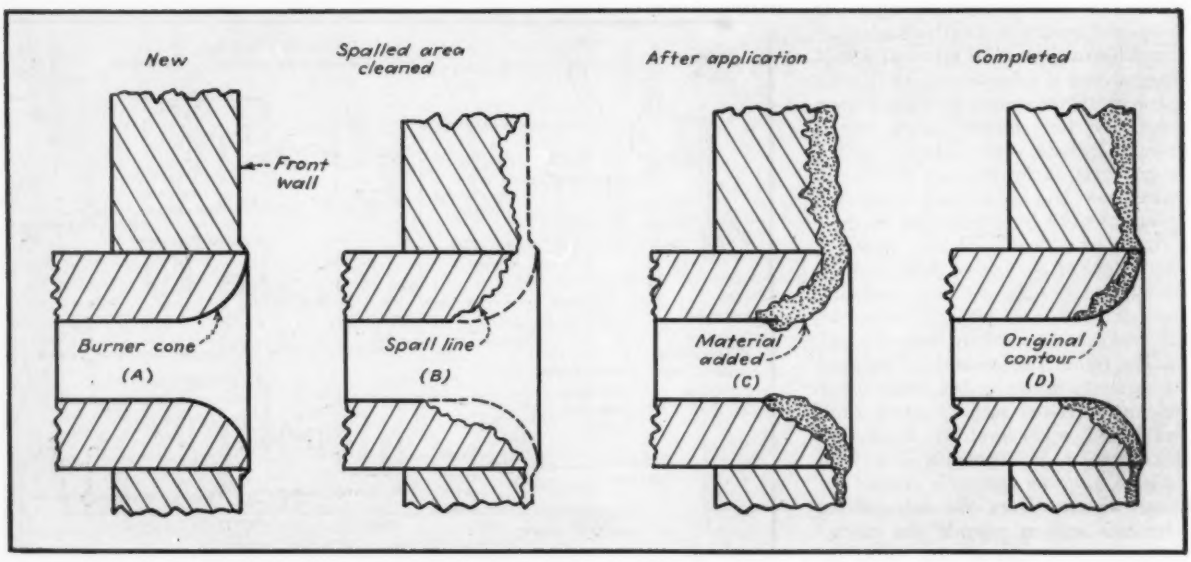


Fig. 2—Burner cone and panel repairs consist of cleaning away the spalled areas, and roughening up the surface to provide keying depressions so the applied material will anchor securely. Surface is then finished to final contour

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the minimum required to provide greatest possible "stickiness" of the emitted refractory. This enables him to build up deep sections, yet eliminates the excess water commonly used beyond that required for ideal hydraulic set. The operation, as practiced at Harbor Steam Plant, is in general as follows:

After the unit has cooled enough to permit work, a thorough refractory inspection is made to determine the extent of damage. Areas requiring repair then undergo surface preparation, which consists of removing all slag and burned refractory, leaving the surface in a toothed condition to which the subsequently applied refractory can key itself. The surface is usually roughened with air chipping guns and particular attention is given to provide "keying-in" points for the coating.

Provide Anchors

When refractory is to be applied to bare metal such as the undersides of boiler drums, studs, wires or ell or tee sections of steel are welded on to provide bonding keys, Fig. 3A. Following this preparation the refractory is "sprayed" on to the required thickness, Fig. 1.

Inasmuch as casting molds or forms are not required to shape and contain the refractory until it sets, the savings of time afforded by not having to construct and apply them can be appreciated.

The type of material applied is dictated entirely by the temperature service and may range from simple refractory clays to sillimanite mullite or the chrome ore base castables as listed in Table 2.

The pneumatic material gun machine is set up near the boiler, but outside the boiler room, Fig. 4. Thus the handling and unbagging of dry castable refractory can be done outdoors, eliminating the attendant nuisance of abrasive dust particles on the machinery. Material conducting hose lengths up to 200 ft are commonly used with differences of elevation between the machine and nozzle of 70 ft.

When the difference in elevation exceeds about 90 ft rate of material flow decreases. It is then desirable to station the machine on the boiler room roof or other higher point. The machine provides all material handling and transporting from the point of unbagging to the actual position of application.

After the machine is loaded and started, the nozzle operator applies the refractory as required, and, by telephone connections within his mask, communicates his requirements to the machine loading crew outside. Obviously the nozzle operator represents the only true skill required, and his training may be obtained in short-time pilot tests prior to the actual application in the furnace.

Easy Contouring

Following application, and depending upon the degree of skill of the operator, certain cleaning or contouring operations may be necessary or desirable, examples of which are shown in Fig. 1 and 2. For the application in Fig. 1, a simple scraping operation to smooth out the high spots and remove small deposits on the tubes is all that is required.

At Harbor Steam Plant we designed magnetically held baffles to prevent application of refractory to water-wall tubes so subsequent cleaning or shaping would not be required.

These special baffles guide the sprayed material away from the tubes and into the spaces between them, Fig. 3B. The two specially cast Alnico V magnets have the shielding steel welded directly to them and the shield is rubber coated to minimize the abrasive effect of the high velocity refractory as it passes by. These shields are attached by merely placing them in position on the tubes where the strong magnets securely hold them.

After spraying the shield is removed simply by grasping one end and pulling sharply. Five sections are used and the nozzle operator's assistant advances them in leap-frog fashion as required.

When the final shape must be more precise, such as a burner cone assembly, Fig. 2, suitable contouring scrapers can be constructed as required. As the nozzle operator develops proficiency a minimum of such contouring will be required, Fig. 6 and 7.

No practical limit has been reached in respect to the depth of application. To our knowledge, there is no central power station refractory thickness requirement in excess of that found possible to apply by this method, either on vertical surfaces or on the undersides of drums, tubes, etc. As the nozzle operator gains experience he will learn how to weave the nozzle stream back and forth to produce a uniform build-up, which inherently eliminates slumping of the applied material.

Types of Refractories

Types and classes of castable refractory materials tested to determine their suitability for this type of application include:

1. Hi-duty base castables.
2. Super-duty clay base castables.
3. Sillimanite mullite base castables.
4. Chrome ore base castables.

To date we have tested materials in each class from almost all large refractory manufacturers and were able to apply them successfully.

Lower heat-duty materials, due to

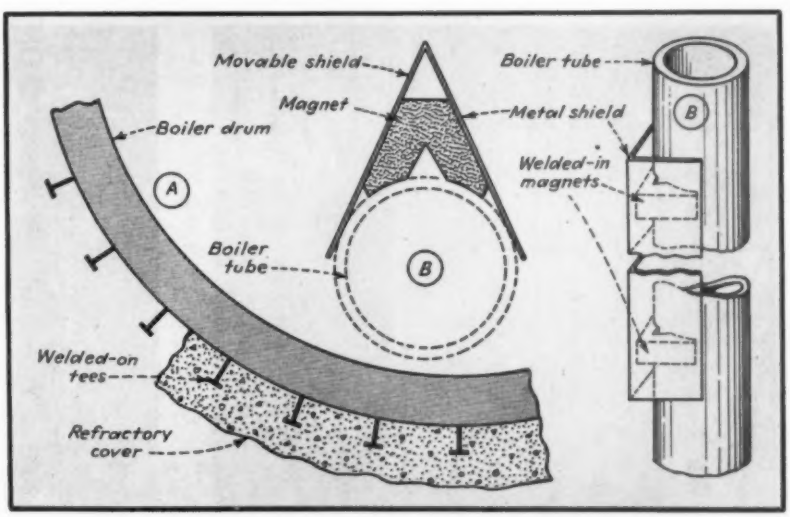


Fig. 3—Where refractory is to be applied to bare metal, studs or tee sections welded to the surface act as anchors or bonding keys to hold material securely

Fig. 4—With machine set up outdoors, the operator wears a throat microphone and headphones to contact man in furnace

Fig. 5—Typical repair setup showing staging, operator's position and air filter used to supply clean breathing air

the greater allowable percentage of *binder,* are somewhat easier to handle as they exhibit a higher degree of stickiness and permit a more rapid build-up of deep sections. In no case, however, has this technique proven unsuccessful with any particular class of material.

At Harbor Steam Plant we require chrome ore, and the rigid specifications under which this material is purchased, particularly as regards temperature service, limits the percentage of binder used, yet no difficulties are experienced in its application.

During application a certain percentage of the sprayed refractory material rebounds from the surface and falls to the boiler floor. This is generally termed "bounce-back" and is composed mostly of the larger particles. With flat or mildly sloping refractory coated floors a high percentage of "bounce-back" is no disadvantage as the material may be left there, perhaps later graded and distributed, to form the required refractory coating.

When furnaces have hopper bottoms or sharply graded floors, loss of refractory by "bounce-back" can be practically eliminated by specifying graded or sized refractory.

Specify Refractories

This sizing eliminates the bulk of the very large particles and groups the remainder within a size range that provides the required refractory properties without an accompanying loss due to bounce. Refractory purchased under specifications in Table 1 has given completely satisfactory results. In general, elimination of the small percentage of particles that will not pass No. 8 screen has been found to be desirable.

When bagged refractory materials are transported a considerable distance from the point of bagging, the vibration and shaking tends to segregate the particle sizes. Thus, it is extremely important that the material be mixed thoroughly before loading it into the machine hopper. This precaution is also advisable for other methods of application that do not inherently assure prior mixing. At Harbor Steam Plant we have not experienced difficulty from this problem.

Based on past experience, drying time for the particular material used is considerably less than that normally observed with the usual methods of casting refractories into place. This, of course, is due to the addition of the near-ideal amount of water for hydraulic set, since no excess water is required to provide mechanical workability of the mass. Actual drying time required, which will vary somewhat with the type

Fig. 6—Completed repair showing a refractory covering over water-wall tube anchors. Final contouring is not necessary

Fig. 7—Repairs to burner cone showing fine texture of the surface. This area does not require contouring before use

of refractory being employed, can readily be determined by examining the surface conditions.

The foregoing method requires one of the several commercially available machines commonly utilized in the application of concrete, plaster, etc. It can be rented or purchased outright, depending upon the individual plant economics. Small organizations will undoubtedly find it most profitable to rent the equipment, while large scale operators having numerous and/or large steam generators will probably find outright purchase more desirable.

Operating Crew

An efficient operating crew consists of a nozzle operator, his assistant, a machine operator and two assistants.

The nozzle operator, being the most skilled, directs the others according to the immediate requirements as he sees them. He works under the direct supervision of the boiler maintenance foreman who indicates the desired repairs and repair details.

The nozzle operator, by means of telephone communications within his protective helmet, directs his assistant in respect to placement of shields, guards, planking, etc. He also directs the machine crew in respect to refractory requirements, water supply, machine operations and related matters.

In actual test taken from a routine run, these five men apply 4,000 lb or 40 bags of chrome ore per hour. No casting forms need be fabricated, applied and then disassembled. Setup time for the machine, hose and other equipment normally requires about 2 hr labor of 5 men. The necessary prior surface preparations are the same as for any other method. This also applies to any staging and platforms that may be required for the job, Fig. 5.

Conclusions

Application of refractory by this method has had no detrimental effects on boiler tubes or drums, and the excellent results received induced us to adopt this method as standard practice for refractory linings. After more than three years of such experience and practice, close examination has revealed desirable savings in outage time and manhours of labor per unit of refractory coating.

Refractories applied by this method exhibit refractory and load bearing characteristics equivalent to the same materials in the cast state. In many instances, where maximum density and minimum shrinkage are required, superior physical characteristics of materials so applied have been noted.

Other refractory users can benefit by the experiences and techniques explained in this article.

TABLE 1—TYPICAL PARTICLE SIZE AND MINIMUM MECHANICAL STRENGTH SPECIFICATIONS FOR REFRACTORY CASTABLE MATERIALS

Characteristics:	Hi-duty castable	Super-duty castable	Sillimanite castable	Chrome castable
Particle Size: (ASTM C-92)				
Pass 8 mesh	97.0	96.0	98.0	98.5
Retained on 12 mesh	7.0	7.0	7.0	9.2
Pass 12 but retained on 50 mesh	46.0	30.0	26.0	25.0
Pass 50 but retained on 100 mesh	15.0	25.0	27.0	30.0
Pass 100 mesh	32.0	38.0	40.0	34.0
Mechanical Strength: (ASTM C-133) Modulus of rupture, psi				
Unfired	350	225	100	236
Fired, Schedule B (ASTM C-113)	1500	1100	690	798

TABLE 2—CLASSES OF REFRACTORY USED FOR VARIED TEMPERATURE SERVICES

High-duty clay base castable (Fusion point—2615 F)*	Baffles; Drum coverings; Behind waterwalls
Super-duty clay base castable (Fusion point 2900 F)*	Sub-floor; Drum coverings; Baffles
Sillimanite Mullite base castable (Fusion point 3200 F)*	Burner panel facings; Burner cone coverings; Front wall facings; Target wall facings
Chrome Ore base castable (Fusion point above 3335 F)*	Waterwall tube space filling; Furnace floor covering; Target wall facing; Front wall facing

Service recommendations approximately 300 F below fusion point.
*GREFCO Handbook of Refractories, Page 194.

Three-Step Insulation Application Saves Time

• A unique method of applying mineral wool board insulation to an air conditioning unit recently enabled the William Penn Hotel, Pittsburgh, to eliminate several time-and-material-consuming steps normally required to insulate such equipment. The technique was used to apply insulation to sheet-metal enclosures for five stages of air conditioning, a circulating fan, and the distribution duct. It included three basic steps in applying (1) special clips, (2) mineral wool board sections, and (3) two coats of paint. Commonly specified materials such as wire mesh, insulating cement, and finishing cement were not required.

The special clips, which secure the insulation to the surface of housing, fan and duct, are attached to the sheet metal by an adhesive. Each clip consists of a 1½-in. square metal plate, punctured with small holes, and a length of heavy-gage wire welded perpendicularly to the metal plate at its center. The punctured metal plates are pressed into the adhesive on 12-in. centers and, when the adhesive dries, each clip is designed to withstand a tensile stress of more than 100 lb per sq in.

Mineral wool board insulation in 24 x 48-in. sections is then impaled on the wires of the clips with all edges carefully butted together. To secure the insulation, a lock-washer is tightly set on each protruding wire. The ends of the wires are then clipped at the washers. Insulation corners and joints, and the tops of the washers are covered with 10-lb asbestos paper carefully secured in place with cold-water paste. To complete the insulation, two coats of paint are applied to all insulated surfaces.

The insulation, thus installed, assures that proper temperature is maintained as air is conditioned and distributed to the dining rooms, lobby and cocktail lounges of the William Penn. Power costs are kept low by eliminating both excessive loss of heat from the two sets of steam coils and unnecessary heating of the chilled water in the fourth stage of the conditioning system.

Although applied to a hotel air conditioning system, this step-saving and cost-cutting technique can be applied with equal advantages to other buildings. Courtesy of Industrial Mineral Wool Institute.

Modern and spacious building addition houses the new dual-fuel 1,200 hp diesel. Old powerhouse is located at the rear

This dual-fuel diesel reduced costs $7,500 a year. Greater savings are expected as older units are converted to gas

LINDSBORG EXPANSION IS PLANNED TO REDUCE COSTS

By installing a new dual-fuel diesel and converting fuel oil units to gas operation costs were reduced from 7.2 mills per kwhr to 3.8 mills

WILLIAM H. GOTTLIEB, *Morrison-Gottlieb*

IN JULY 1949, the City of Lindsborg, Kansas, paid 7.2 mills in fuel bills for every kilowatt hour generated. Just four months later the plant average was down to 4.7 mills, and the most economical unit produced a kilowatt hour for a fuel cost of only 3.8 mills. This is a story of a plant in transition, of an old plant taking advantage of modern technological advance, moving forward to economies unprecedented in its 45-year history.

Lindsborg made a big step forward in 1947 with the installation of a 700-hp diesel, a heavy-duty, pump-scavenging, two-cycle engine with full pressure lubrication and oil-cooled pistons. In two years, this unit rolled up more than 10,000 engine hours and improved plant efficiency. However, the swiftly expanding load demanded further expansion of generating capacity. The city's next major step was the erection of a spacious modern extension to the old powerhouse and the installation of another engine. The new unit, put into operation on July 22, 1949, has 6 cylinders of 16 in. bore, 20 in. stroke, and develops 1,200 hp at 300 rpm. It was designed for dual-fuel operation.

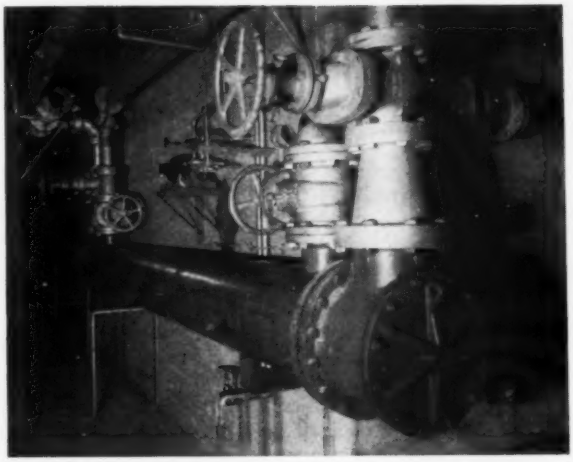
For a short time, pending arrival and installation of the dual-fuel parts, the big engine was run on diesel fuel; later the unit was switched to natural gas with oil as a pilot fuel. Power production, which had climbed just 457,800 kw hr in the eight years from 1938 to 1946, zoomed another 1,348,000 kw hr to a peak of 3,228,200 kw hr in 1949. The year 1950 is running substantially higher.

Effect of the new engine and switch to dual-fuel has been so marked that progress in production economy is a story of months rather than years. In the first seven months of 1949, before it went into service, the plant generated 1,651,700 kw hr while consuming 145,630 gal of fuel oil, an average of 11.34 kw hr per gal. The cost of fuel per kw hr averaged 7.2 mills. In the next four months, with the new engine in operation as a full diesel, plant production was 1,014,700 kw hr on 81,530 gal of fuel, an average of 12.44 kw hr per gal. Fuel costs per kw hr were 6.6 mills. In the eight months from December 1949 through July 1950, with the new engine operating as a dual-fuel, total plant production was 2,123,200 kw hr on 79,062 gal of oil and 20,779 MCF of gas. Average fuel cost was 4.7 mills per kw hr. In that period, the dual-fuel unit generated 1,497,500 kw hr at an average fuel cost of 3.8 mills per kw hr.

In developing this engine, the manufacturer has adhered to basic design, and any unit can be converted in the field to dual-fuel operation. Thus the fuel system of the 1,200 hp engine was duplicated when an existing 700 hp unit was converted. Natural gas

PRINCIPAL EQUIPMENT AT LINDSBORG, KANSAS DIESEL PLANT

Engines	Fairbanks, Morse & Co.
Alternators	Fairbanks, Morse & Co.
Lube oil	Sinclair Refining Co.
Lube oil cooler	Ross Heater & Mfg. Co., Inc.
Lube oil strainer	Purolator Products, Inc.
Lube oil purifiers	Honan-Crane
Lube oil pumps	Geo. D. Roper Corp.
Fuel pump	Viking Pump Co.
Fuel oil meter	Neptune Meter Co.
Fuel oil filters	Wm. W. Nugent & Co., Inc.
Cooling water tower	Diesel Service Co.
Water pumps	Fairbanks, Morse & Co.
Water pressure alarm	Mercoid Corp.
Air filters	American Air Filter Co., Inc.
Exhaust silencers	Maxim Silencer Co.
Switchboard	Westinghouse Electric Corp.
Voltage regulators	Westinghouse Electric Corp.
Alarm panel gages	Manning, Maxwell & Moore, Inc.
Alarm panel pyrometer	Illinois Testing Laboratories, Inc.
Water softener	Oshkosh Filter & Softener Co.
Batteries	Electric Storage Battery Co.
Compressors	Fairbanks, Morse & Co.



Lube oil for the 1,200 hp engine circulated in this heat-exchanger is cooled with water from a forced-draft tower

The enclosed switchboard has electrically operated switchgear and a complement of control and recording equipment

passes first through a meter and then through a regulator, which cuts pressure to 25 psi. Gas passes through a safety cut-off valve actuated by engine lube pressure. This valve admits gas to the engine only under the following conditions: if the engine speed is high enough to bring lube to operating pressure; if pilot fuel pressure is sufficient to insure ignition; and if engine speed is not excessive.

Gas next passes through an admission valve actuated by governor linkage. Pressure is controlled in the gas header extending along the cylinder heads and consequently regulates the gas quantity admitted through constant-lift, cam-operated valves.

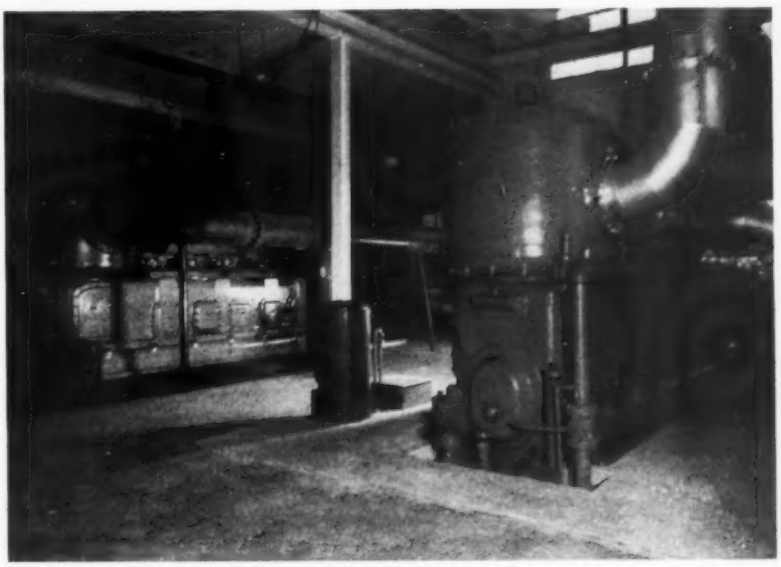
Pilot oil charge for initiating combustion does not vary in quantity and is injected by a separate small-volume fuel pump for each cylinder, permitting a precisely regulated supply. The engine is equipped with standard diesel fuel pumps, which function when the engine is operating wholly on oil. They also cut in automatically to compensate for any gas deficiencies during dual-fuel operation. Both pumps use the same injection nozzle.

To insure a favorable gas-air ratio, scavenging air is admitted to the cylinders by a governor-controlled valve. Gas and air supplies are separate and independently controlled so there is always enough air for full combustion even with gases of low Btu content.

While fuel savings are the largest single factor in dual-fuel economy, there are other advantages worthy of note. Oil economy was good before the switch to gas with an average of 4,888 hp hr per gal of lube consumed. In eight months as a dual-fuel, the engine ran 3,421 hr and consumed 763 gal of lube for an average of 5,380 hp hr per gal. Lindsborg promotes efficient and economical lubrication with good accessory equipment. Each engine is served continuously by a Fuller's earth purifier. Included in the lube circuit are a cooler, strainer and a motor-driven auxiliary circulating pump. As a guide to lube handling, samples of oil are submitted periodically to laboratory analysis. Since the purifier installation, improvement in oil condition and engine cleanliness has been so marked that city engineers plan to pull pistons only once every two years instead of every year as has been their custom.

Soft water is circulated through the engine jackets and the coils of a forced draft cooling tower by motor-driven centrifugal pumps. There are three sets of coils in the tower and piping arrangement permits use of any one or combination. Impurities are removed from scavenging air by multi-element filters housed in air chambers. A separate alarm panel includes an exhaust pyrometer, alarms on fuel pressure, lube pressure and water temperature.

The plant's panel switchboard is of the all-enclosed, unit type and is equipped with electrically-operated switchgear, voltage regulators, totalizing kilowatt-hour meters, recording kilowatt meter and voltmeter, watt-hour demand meter, time overcurrent relays, ammeter, kilowatt and power factor meter for each engine panel.



Exhaust end of the new 1,200 hp diesel (right), and existing 700 hp unit (left) that has been converted to dual-fuel operation. This increased the capacity to 1,200 hp

TELEVISION

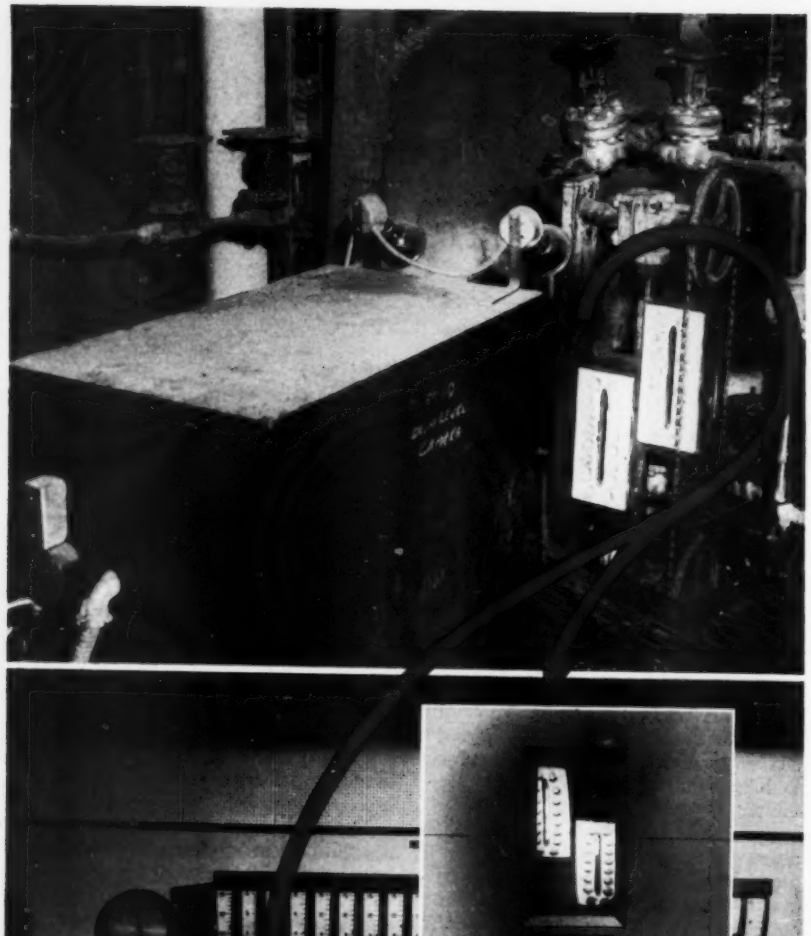


Fig. 1—From a hot, inaccessible spot eight floors up, camera's view of the gages is sent to the control panel, enabling the operator to make immediate adjustments

MANY TYPES of indicators tell control panel operators about remote occurrences, but now, in effect, they can be present at the scene of action. This has been made possible by the application of wired television. A camera, focused on the object or event, is connected by coaxial cable with a receiver, or monitor, which may be at a considerable distance. The camera's field of view appears on the monitor screen.

To date, chief use of such units has been to enable operators to see boiler water level gages eight or more floors above the control panel. The panel may be in a closed room if desired and at almost any location with respect to the boiler or boilers. Heretofore, systems of mirrors often have been employed to reflect water gage images. Limitations of such equipment are well known and mirrors generally are not practical except when the observer is within a reasonable distance of the object and in an area of uninterrupted line-of-sight paths. This and other objections are removed when a suitable television setup is employed.

Water-Level Indicators

Equipment available from Diamond Power Specialty Corporation under the name "Utiliscope" has been applied in several large power stations and for other industrial purposes. Details need not be given here, but equipment includes a camera and power unit, plus an indicator for the variable to be measured, set up at the desired station and a monitor with a cathode ray tube incorporating the viewing screen. Camera and monitor have a total power input of 225 w. Designed specifically for industrial use, the equipment has only about half the number of components of domestic units.

Camera and viewer are connected by a coaxial cable and have, of course, supplementary electronic equipment. Power supply is 105-120-v single phase and is commonly 60-c. When the object or events to be viewed do not have sufficient brilliance to yield a satisfactory image, auxiliary lighting must be provided.

As the image produced on the viewing screen is black and white, there must be sufficient contrast at the source to provide a suitable image. In a water gage, for example, contrast between water and steam is not adequate with

. . . THE EYES OF INDUSTRIAL CONTROL

Video has put on overalls and gone to work in the plant. Its service is not a report or an indication, but an instantaneous view of remote or dangerous events transmitted to a screen in a centrally located control room or office

HERBERT CHASE, M.E., *Consultant*

direct illumination, hence these applications all have the Diamond two-color type in which steam appears red and water green. These colors are not transmitted as such but do provide the contrast needed because the camera is much more sensitive to red than to green light. On the viewing screen, the steam shows light and the water dark, the demarcation being well defined.

These two-color gages have incandescent lamps with reflectors behind the gage glass and the usual prisms in front. When used with the television setup, the front face of the gage around the window is painted white and illuminated by spot lights placed on or adjacent to the camera. The image transmitted shows not only the columns of water and steam but the face of the gage as well.

Among important installations are those employed in connection with two new boilers of one million lb per hr capacity installed in the Waterside station of Consolidated Edison Co. in New York City. These boilers generate steam at 1600 psi and are connected to topping turbines that drive 13.2 kv generators of 50,000 kw capacity. Additional power is generated by the exhaust steam.

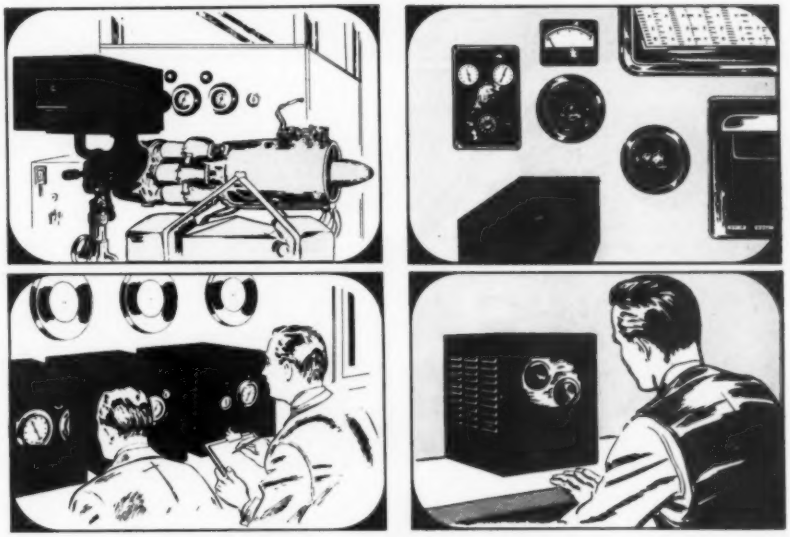


Fig.2—Television overcomes hazards of viewing instruments or exhaust in test room, left, as easily as it spans 1000 ft between instruments and observer, right

Installations

These installations are illustrated in Fig. 1. Cameras rest on the grating floor and are focused on the double gage having its center about 2 ft above the eighth floor grating, some 85 ft above the control panel carrying the monitors. About 110 ft of coaxial cable connect each camera and its monitor. Viewing screen of the monitor is directly back of an opening in the control panel, so that the operator can always see an image of each gage and read the water level clearly. Ambient temperature around the cameras approximates 115 F which is well below

Fig. 3—Remote viewing facilitates material flow. Man watches two points for coal pile-up, left. Distant observers control process using radioactive material, right

Fig. 4—Above. Camera views reflections of six pilot burners and transmits them to control panel screen below. Operator starting boiler avoids errors and delays which frequently occur when he has to depend on relayed reports of an assistant

the design maximum of the equipment.

Besides the convenience of having images of water level gages always in view of the control operator, there is a direct saving estimated at 20 man-hours a day. It is no longer necessary to employ men to keep gages in view (either directly or through a mirror system) as would be required on all three shifts if the installation described were not used. Labor savings are expected to amortize cost of installation soon and it was largely this fact that justified the investment.

Smoke Control

Because of the need for keeping track of smoke conditions at stacks, a purely experimental setup has been made at the same plant. A camera placed on the roof of the station is focused on the top of one stack and connected to a monitor in an engineering office. As this is written, however, the installation is too new to have determined whether it will yield desired results under the varying weather and other conditions that apply, or whether it will achieve significant savings over other checks in current use.

Other installations, in combination with bi-color water level gages, are reported. One is at the Fisk Street Commonwealth Edison Co. plant in Chicago, another, at the Tidd station of Ohio Power Co.

At the Tidd station, another application enables the control room operator to tell at a glance if pilots in six boiler furnaces are lighted. A glass bull's-eye is supplied for each pilot and shows a light if the pilot is burning. All bull's-eyes are in a row along a runway and a set of mirrors, Fig. 4, is so arranged that light from each bull's-eye is reflected into a single camera. An image of each appears on the monitor screen on the control panels, Fig. 8, when all pilots are lighted. If one or more of the images disappear, the operator knows at once that the corresponding pilot is not burning.

Before this installation was made, the control operator depended upon an intercommunication system to keep in contact with an auxiliary operator in the furnace burner area to watch and report when any pilot was out. This introduced possibility of dual human errors and led to confusion, possible delays and hazards, especially during the critical periods of lighting burners to bring boilers into service.

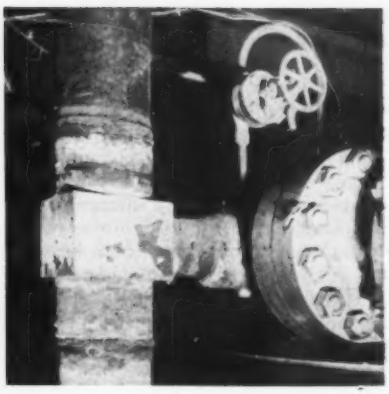
Pilot-Light Viewing

With television, the control operator can instantly see which pilot is off. Delays and uncertainties are avoided and he can give immediate orders when relighting is required. Responsibility is thus centered with the control operator, where it should be. There are some savings in labor but decrease in hazard and centering of responsibility are primary considerations that justify the new installation.

Wired television, if it does fail, "fails safe". It cannot convey false information, which is not true of all types of equipment. Should there be failure in the camera, monitor or connected equipment, no image appears.

Because industrial television is a closed circuit, non-broadcast system, it is free of many of the restrictions imposed on broadcast apparatus. Number of lines and synchronous field rate, for instance, can be chosen to suit the application. With only 17 tubes, about half the number in home receivers, the equipment can be made simple, compact and portable. Furthermore, operation is stable and equipment, once set, can be turned off and on without adjustment.

Because of the newness of wired television, many possible industrial applications remain to be investigated. However, it should be of value where direct observation is excessively costly, dangerous, uncertain, slow, inconvenient, tiring, hot or cold, or too distant. Indicated uses include viewing of destructive or dangerous tests, atomic reactions and operations such as steel pouring, as well as avoiding pile-up or accidents on conveyers and the like.



Maintenance operations take place on a wide variety of shapes and steels. By reducing temperature differentials and cooling rates, preheating decreases stresses, warping, hard zones and cracking. Postheating relieves stresses and tempers hard zones

Critical Steel Parts Need

PREHEAT AND POSTHEAT FOR WELDING

Here are the reasons auxiliary heat often prevents failures in welding. They are of special importance in maintenance because critical parts must be joined satisfactorily the first time, usually without benefit of steel analysis or of practice

WHILE WELDING has become a valuable and indispensable tool for maintenance and construction operations of the plant engineering group, some applications and limitations are not adequately recognized, resulting in failures that make many engineers consider it a risky process.

Metal successively expands, upsets and contracts when heated locally or under restraint. On hardenable steels, the quenching effect of arc welding causes hard heat-affected zones. These two effects cause most failures in miscellaneous maintenance welding jobs, as on machine parts, dies and cutters, but they can frequently be avoided if the proper heat-treatment is used.

Maintenance engineers must have adequate information at their fingertips to size up a repair or construction job on the spot and to plan its execution immediately. This discussion is intended to cover the field briefly, yet completely enough to help them plan procedures, or at least to provide facilities needed if a welding engineer is to supervise actual operations.

Expansion and contraction of steel as a result of heating is an old story, but the upset which occurs in heated areas restrained by surrounding metal is generally overlooked. For example, a heated bar tends to expand in all three directions, Fig. 1 in A. But if the metal is restrained in one direction, the increased volume, represented by dotted lines in B must be obtained by increases in width and thickness in addition to expansion caused by heating.

The effect is as though the metal had expanded to the dotted lines and then been pushed back within the confining structure. Expressed in this manner it is easy to see the large forces necessary to compress the length of the bar for even the small distance represented by thermal expansion. These same forces develop when the bar is confined.

Restrained Sections

A bar, restrained and intensely heated over a small part of its length as in B, will tend to expand and potentially may develop exceedingly high forces —except that in heating the metal has become softer and will upset in the heated zone.

Where the upset bar is free to contract on cooling, it will pull away from the restraining yoke, as in C, by roughly the same amount it would have increased in length had it not been restrained during heating. To close the gap, as in D, or keep it closed, it is necessary to stretch the bar. Since it cools before maximum contraction occurs, the metal will have regained its cold strength and exert correspondingly high forces. Frequently, the amount of contraction is so great that the force necessary to keep the gap closed, (as where bar is fastened to yoke) is more than the strength of the bar which will then take a permanent set, or crack if ductility is low.

Even when the bar yields and relieves part of the strain, the stress remaining is roughly equal to the yield strength of the metal. This, with the counteracting stress in the yoke, constitutes the residual stresses in the piece.

A flexible yoke would bend during heating and limit amount of upset in the bar. Consequently, on cooling, the contraction would not be so great. Also, the flexible yoke would bend inward on cooling, or the piece as a whole warps. Residual stress in this case is determined by stiffness of the yoke.

From the simple example given, the engineer may visualize almost any structure broken into small elements and predict the effect on the whole as a summation of individual effects. Each element, as in Fig. 2A, will be modified by the conditions of rigidity existing in the part being welded.

For example, one extreme is illustrated by the solid piece in Fig. 2B, where the bar is represented by dotted lines and the yoke is so heavy as to become an integral part of the bar. This condition occurs on blocks or heavy plates. Upset occurs in welding even though masked by the weld bead, and high residual stresses are present. The other extreme is the unrestrained

bar in Fig. 1A, which is free to expand and to contract back to its original dimensions with little residual stress.

In the previous discussion, the yoke was assumed to be at room temperature and a limited area in the bar was intensely heated almost to the melting point (above the melting point in the fusion zone) by welding. Note that the effects result from a difference in temperature, about 2500 F in this case. If the whole structure had been heated before welding, the temperature differential would be reduced by the amount of preheat and expansion, contraction and stresses correspondingly decreased.

Preheating

The welding operation raises the temperature of the weld zone well above the critical point of steel, and, as the operation progresses, cold metal adjacent to the seam rapidly draws heat away as surely as though the part had been dropped in water or oil. In other words, metal in the weld zone is quenched and hardens to an extent that depends on severity of quench and hardenability of the steel. Water-hardening steels need a very rapid quench and require the severe chilling effect of water for maximum hardness. Oil-hardening materials will harden if cooled at a slower rate, and air-hardening metals are so susceptible that the slow cooling effect of air is adequate to produce the desired hardness in the finished job.

In order to be hardened, most steels must be cooled below about 600 F faster than their critical quenching rate. When water- and oil-hardening steels are preheated above this point, the cooling rate is delayed enough to prevent hardening. Even with lower preheats, the added heat of welding, especially gas weldings, may be adequate to prevent quenching. On air hardening steels, however, the weld zone may cool to the preheat temperature, and then to room temperature after the operation is completed, fast enough to produce hardening unless the part is properly furnace cooled immediately after welding.

Remembering that a steel will not crack unless it is pulled apart, preheating has the double-barreled effect of reducing stresses and hardness or brittleness. However, preheating can destroy previous heat-treatment of a part and is frequently limited to previous draw temperatures.

Proper local preheating will prevent hard zones in most steels. However, the temperature differential between the heated area and the rest of the part may induce warping and residual stresses. It should be used with caution on critical parts where the heated area is strongly restrained.

A good general rule to follow is: on *hardened* steels that are not to be reheat-treated limit preheat temperatures to the draw temperature and heat the whole part, or as much as possible.

Draw temperatures on extremely hard steels (except air hardening, high speed, etc.) are probably not much over 400 F. Steels that can be filed, though with difficulty, could be safely preheated to 500 F. Still softer steels, about the hardness of screw drivers and wood saws, are probably tempered at about 600 F, or above. Parts heat-treated for strength and toughness rather than hardness are usually tempered at 800 to 1100 F.

Postheating

Postheating is a general term that includes any heating process performed after welding. Soaking times at temperature of treatment of one hour per inch of thickness are generally recommended for preheating and postheating.

Maximum temperatures for *hardened* steel parts are, of course, limited.

Stress relieving. Strength, or yield point, of many steels increases slightly and then drops off rapidly as the temperature is increased, as illustrated in Fig. 3. At the same time, ductility usually increases. Postheating softens the material, allowing stressed sections to "give" and reduce internal stresses to the yield strength at the maximum temperature attained. Note again that yielding means the part warps, which may or may not be important.

Stress Relieving

Postheating for stress relieving is usually carried out at from 1100 to 1200 F. This temperature reduces stresses to a generally unobjectionable value, yet does not appreciably affect the strength of cold worked materials. It cannot be used without softening water- or oil-hardened steels.

There is some question of the value of heating ductile material to relieve stress because the strained sections will yield under the first appreciable load. However, it should be remembered that complex parts may have hard brittle sections or small ductile sections, which may fail because of strains imposed by the heavier connecting structure.

Machining may remove a layer of material containing residual stress and permit opposing stresses on the other side to bend the part. Stress relief is frequently applied after welding so that the material will hold its shape during and after machining.

Annealing temperatures above the critical point (1700 F for low carbon down to 1400 F for tool steels) of the steel cause the metal to recrystallize and destroy previous effects of heating and quenching, as well as of work hardening. Full annealing will remove hard spots and zones from the weld area and will release all internal stresses. It cannot be used on hardened parts unless they are to be reheat-treated, as after machining.

Normalizing differs from annealing which involves slow cooling, as in a furnace. Normalized parts are also heated above the critical but are cooled more rapidly in still air at room temperature. Finer grain structure and greater toughness result. However, uneven cooling caused by different section thicknesses or by placing the part on a cold table may result in again producing residual stresses.

Tempering. Hardened areas in the heat affected zone are softened and toughened by tempering as in the original heat-treatment. Where stress re-

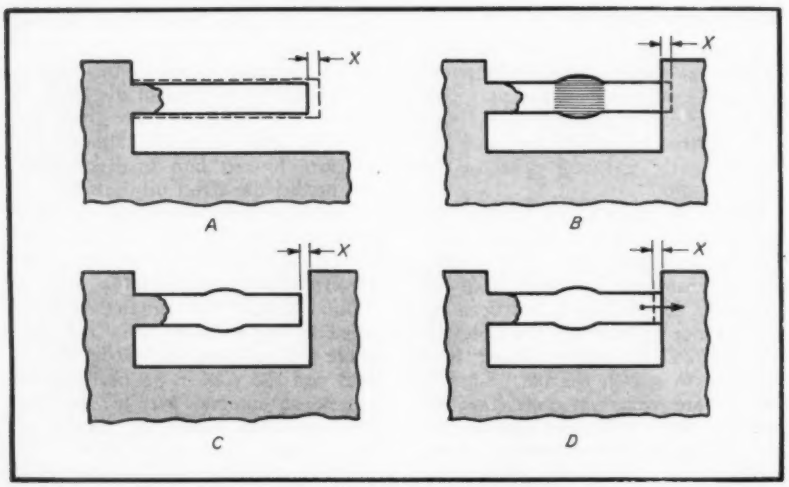


Fig. 1—Unrestrained bar, A, is free to expand and contract. Restrained bar, B, upsets in heated zone, cools to shorter length, C, or stresses end connections, D

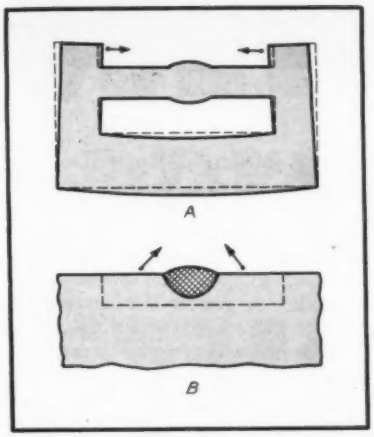


Fig. 2—Lower stresses, greater warping occur in thin sections, A, than solids, B

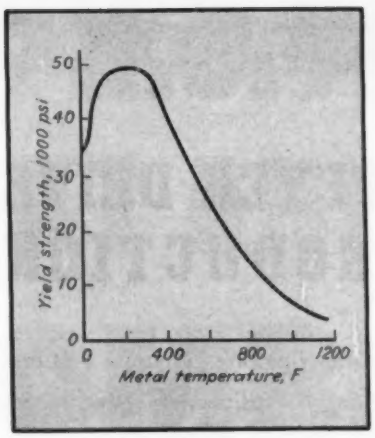


Fig. 3—Heat reduces strength of metal. It yields until stresses equal strength

lieving and annealing temperatures would adversely soften a part, it is usually worthwhile to reheat a critical, hardened part to the draw temperature so that the weld zone will be less brittle.

In the fusion zone of the weld, electrode and base metal are mixed. Alloy electrodes may produce a more hardenable weld junction which could not be softened except at temperatures that might destroy the hardness of the rest of the part. Use of such electrodes therefore depends on subsequent treatment and operations on the part.

General

Preheating may reduce residual stresses, warping and hardening. However, the temperature required if preheating alone is used may make it difficult for the operator to work.

Postheating may remove residual stresses and hard zones, but it obviously cannot prevent cracks that form during or immediately after welding.

Therefore, both may be used on critical parts. On hardenable metals, a mild preheat of 200 to 700 F may be used to reduce warping and cracking, and followed with a higher postheat for tempering, stress relieving or annealing. Mild steel is seldom preheated except to prevent warping or to reduce chilling effect when hard facing. Some low alloy steels are sensitive to cracking and require preheating, followed by stress relieving and annealing if necessary.

All too frequently, the kind of steel and its previous heat-treatment is unknown. It is usually safer to assume that heavily loaded parts, though apparently as soft as mild steel, are an alloy and they should be treated as a hardenable steel. Hardened parts are usually water- or oil-quench steels. Certain very hard, machine parts and some dies are made of air hardening steels which require preheat and postheat temperatures that would soften water- or oil-quenched materials.

Austenitic arc welding electrodes, such as stainless steel and nickel, are frequently used on hardenable parts which cannot be adequately preheated and postheated because of working conditions, a previous heat-treatment which must not be altered, or because the proper draw temperature is not known. These electrodes are tough and ductile and will yield before the hardened metal in the heat-affected zone cracks. They cannot, of course, prevent stresses, warping, or cracking outside the weld area. Critical parts should be preheated to 300 or 400 F to reduce temperature differentials as much as possible.

Brazing is frequently used in gas welding for the same reasons as austenitic electrodes in arc welding. The gas process has the added advantage that the heat is spread over a larger area, reducing sharp temperature gradients and strains. On the other hand, softened areas in hardened steels are extensive, and the process is slower.

HEATING METHODS

Local heating, machine parts

Acetylene torches
Gas burners, (torch and plate types)

Full heating, medium sized machine parts

Heat-treating furnaces
Loose firebrick enclosures, gas burners
Acetylene torches

Full heating, large parts, (flywheels, etc.)

Annealing ovens
Loose firebrick enclosures with gas burners or charcoal fire. Asbestos paper roof with hole permits welding without removing part from heated enclosure

Pipe, shafts, etc. of alloy steel

Suitable modifications of above methods
Electrical resistance strip heaters
Low frequency induction

New Values in Practical Electrical and Photometric Units Established by Law

● By an act approved July 21, 1950 (Public Law 617), the 81st Congress has given formal statutory sanction to a revision of the practical system of electrical units. In large part, values adopted resulted from research by the National Bureau of Standards which proposed present legislation. Changes in magnitude are small, in no case larger than 1/20%, but the new law puts the values on a clear basis assuring closest practical agreement between electrical and mechanical units.

The old law, enacted 56 years ago, included double definitions. There were no central standards laboratories at that time, and to enable any competent laboratory to set up valid electrical standards, the ampere was defined by rate of deposition of silver, the ohm as the resistance of a specified column of mercury, and the volt as a specified fraction of the electromotive force of a standard cell.

These conventional standards did not produce exactly the intended values. Technical and scientific developments made it increasingly inconvenient to have electrical units not strictly consistent with those of mechanics. Furthermore national standards laboratories were established in all of the larger industrial countries.

Recognizing changed conditions, the AIEE proposed a return to the basic "absolute" units. Twenty years of research and negotiations were required for unanimous international action. The story is told in NBS Circular 475.

The new Act is similar to the old law in defining the fundamental practical units as multiples of units of the centimeter-gram-second electromagnetic system. However, they are also component parts of the meter-kilogram-second system which is being widely accepted in textbooks and in engineering practice. Two sections of the Act define the basic photometric units, the candle and the lumen, which were not previously defined by law.

The ohm is now defined as one billion cgs resistance units and the ampere as 1/10 of one cgs current unit. From these, volts, coulombs, farads, henrys, watts, joules and kwh are derived by standard formulas.

The candle is 1/60 of the intensity of one square centimeter of a perfect "black body" at the temperature of freezing platinum. The lumen is the flux in a unit solid angle from a one candle source.

COMPACT CONVEYER DRIVE AIDS LINE PRODUCTION

Here is a speed control unit for a production line conveyer that has a differential of 7.75 to 62 in. per min. An adjustable speed motor operates from a compact assembly that affords a 60% space saving

THERE ARE important cost-reducing results now being secured at Perfection Stove Co. through the use of an all-electric adjustable-speed drive operating from the plant's incoming a-c supply line. The space-saving feature is of particular importance as efficient utilization of floor space is a prime necessity. At this huge Ivanhoe Road Plant four assembly lines are currently in operation.

Perfection in 1948 expanded its Ivanhoe Plant facilities at a cost of $7,000,000. All of the latest equipment, such as the all-electric adjustable-speed drive, was installed with an eye to maximum efficiency, economy and simplicity of operation. The conveyer drive equipment now in daily operation has clearly proved itself a sound investment in material handling, efficiency and economy.

Ability to control conveyer operating speed closely and dependably at all times marks an important manufacturing consideration. Assembly, testing and crating operations are performed in sequence as stoves move along 175-ft lines. Low speeds are essential, especially at times of launching production of new models.

Greater Speed Range

Prior to the present drive installation, the minimum line speed available was 17 in. per min. This rate proved too rapid for some operations, and the product quality was jeopardized. Now as a result of the easily-controlled all-electric adjustable-speed drive, the line can be operated at speeds of from 7.75 up to 62 in. per min. Speed range availability is greater than previously possible. Maximum operating speed although utilized infrequently is of advantage in clearing the conveyer rapidly.

Appreciable economy in floor space has been gained with this new conveyer drive. In fact, it occupies about 10 sq ft as against 25 sq ft required for the former equipment, thereby netting a space saving of some 60%.

Close, accurate speed control is readily achieved by a simple and direct means of unlimited selectivity without resorting to mechanical clutches or speed changers. The system consists of three basic components: 1. An adjustable speed drive motor, for connection to the driven machine; 2. An operator's control station, furnished in conventional (NEMA No. 1) enclosure and 3. A newly-designed control unit, which provides controlled electronic rectification that includes enclosed contactors and overload relays to obtain the desired functions.

Drive motor speed is controlled by varying armature voltage, and this operation offers an infinite number of speeds over a wide range. Once the desired speed is selected by the adjustment rheostat, electronic circuits maintain motor voltage at that level.

Drive equipment is located immediately adjacent to the conveyer line. The control unit, with its simplified electronic circuits, is conveniently mounted on a nearby structural column beyond range of possible harm. Also on this column, at chest level, is the operator's control station containing the speed adjustment rheostat and starter box. This arrangement makes possible accurate control of conveyer speed, and it can be easily adjusted by visual inspection at all times.

Adjustable-speed gearmotor is rated one horsepower with 8 to 70 rpm speed range, the drive-motor powers a 25:1 worm gear reducer. The entire unit is mounted on a flat metal plate and surrounded by a frame covered with wire mesh screen for safety to workmen passing by. A steel sheet, hinged to the frame, is closed during operation.

Other advantages of this designed-and-engineered all-electric variable-voltage drive are low first cost, simplicity of installation and operation, and reduced maintenance attention.

Control unit, mounted on structural column, is easily operated to hold ideal optimum speed. Drive motor and gear reducer are totally enclosed while in operation

SUNVIS H.D. 700 OILS PREVENT AND CURE "THROMBOSIS" IN PRODUCTION MACHINERY

Reduced output and extra maintenance cost are the penalties when clogging occurs in the oil circulating system of machinery. But this costly production ill can be avoided. Sunvis H.D. 700 Oils *keep circulating systems clean*. What's more, if trouble exists now, Sunvis H.D. 700 Oils will *free oil lines and bearings of foreign matter*. They go to work immediately loosening up and carrying away any accumulation of dirt, carbon, water, or other contaminants.

Sunvis H.D. 700 Oils are specially developed for modern circulating systems on machines operating where contamination is a troublesome factor. Sunvis H.D. 700 Oils are extremely stable and have long life even under the most adverse conditions. They have inherent rustproofing characteristics, and the high film strength needed to eliminate scoring on heavily loaded antifriction type bearings.

Sunvis H.D. 700 Oils are also fully detergent, dispersive, and resistant to foaming, and are available in all required viscosities.

For further information about Sunvis H.D. 700 Oils, write for booklet IP-12.

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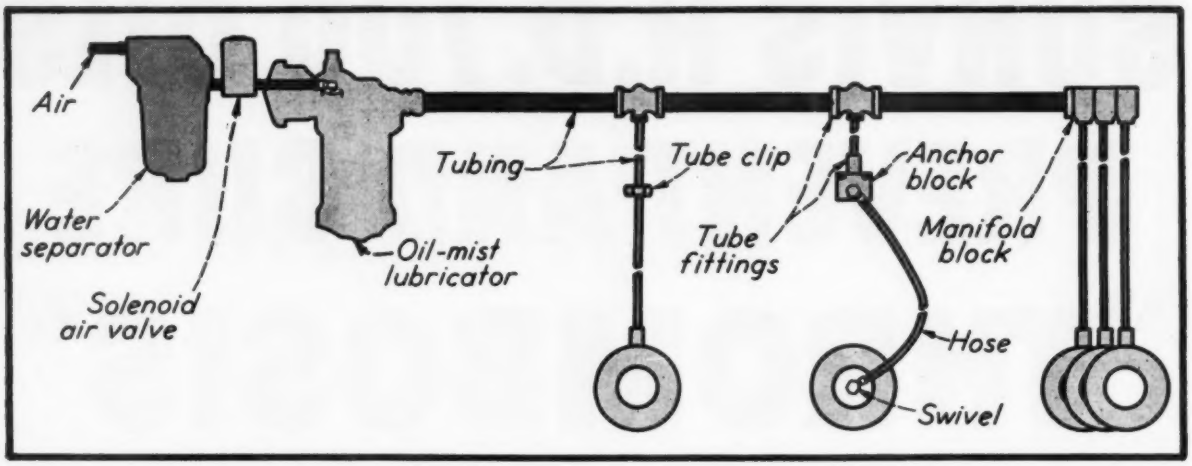


Fig. 1—Heart of the system is the lubricator where the oil is atomized into a mist by means of compressed air. This mist delivered to the bearing or moving part is under slight pressure to prevent entrance of dust and abrasives

OIL MIST LUBRICATION . . . .

provides longer bearing life, lower maintenance costs, greater overall efficiencies and cooler operating units because oil in a mist form is sprayed under a slight pressure onto operating parts of the machine

E. RALPH HARRIS, *Alemite Div., Stewart-Warner Corp.*

PROPER OIL FILM on a bearing represents good lubrication. The problem has been to consistently maintain that film, and we believe a tremendous stride in that direction has been made with the Alemite Oil Mist lubrication system. This method is a continuous, automatic, oiling system, which provides controlled oil lubrication for practically any bearing.

Both coolant action and protection against dust and abrasives on bearing surfaces are provided. The cooling action arises from two conditions. One is application of just the right amount of oil, thus preventing "fluid friction." The second, is the passage of the air, which delivers the mist through the bearing. Pressure of the air carrying the mist is slightly greater than atmospheric pressure. Thus, dust, abrasives or other harmful matter in the atmosphere are kept from entering.

Principle of the system offers exceptional flexibility of application to many types of machinery. Two designs have been built, one for use with an outside air supply, while the other has a built-in air compressor.

The system consists of a lubricator, delivery line, bearing connections, air supply, and lubricating oil. The heart of this system is the lubricator, which atomizes the lubricating oil into mist by means of compressed air. This unit, attached to each machine, is slightly smaller than the oil filter on a passenger automobile. In operation, there are no moving parts. It consists of the following: (1) oil mist outlet, (2) oil reservoir, (3) oil volume regulator, (4) air pressure gage, (5) air pressure regulator, (6) air supply line, and (7) oil fill plug.

Only two controls are used, one is a built-in air pressure regulator, the other is a needle type valve controlling the flow of oil. In operation only dry clean air must be used. A new water separator, self-emptying, without interruption while in use, is provided to assure dry, clean air for the system.

(Continued on page 115)

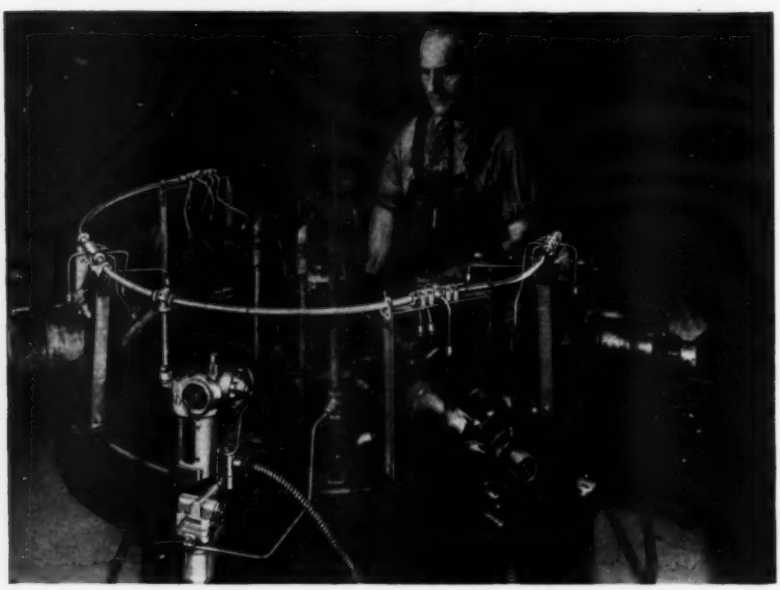
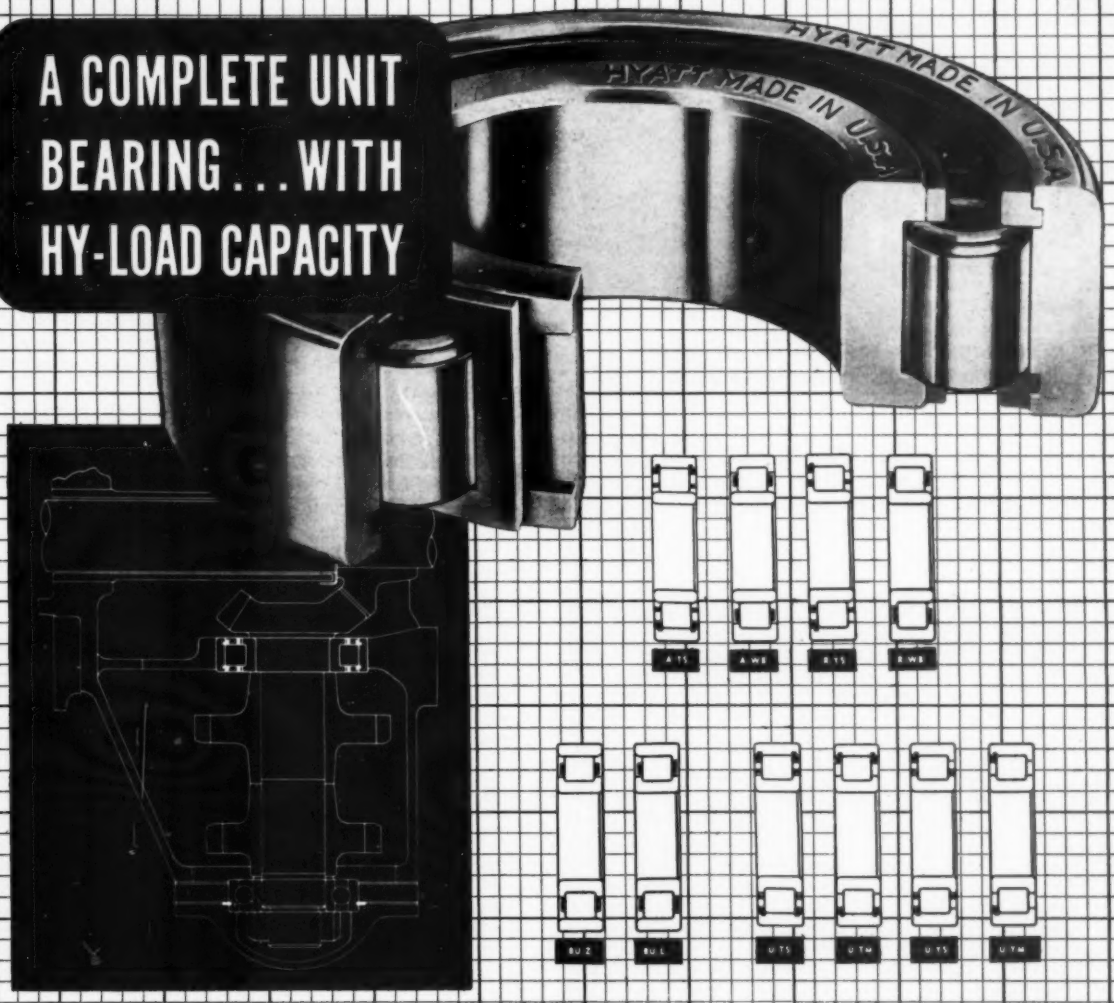


Fig. 2 — Drill machine lubricated at 20 points from main line. Air mixed with oil is distributed to bearings

A COMPLETE UNIT BEARING . . . WITH HY-LOAD CAPACITY



HERE is a cutaway illustration and typical application of the "U-TS" type Hyatt Hy-Load straight cylindrical bearing which has rollers, separator and races assembled into a single non-separable unit. The inner race has flanges and the outer race is grooved at both ends to accommodate retainment rings. The rollers are separated and spaced by a one-piece separator.

The "U-TS" type bearing is often employed in applications where no shoulder or stop is provided to retain the outer race in an axial direction or where the bearing must be assembled as a unit.

Separable inner race, separable outer race and complete unit Hy-Load Bearings are available with varying combinations of retainment rings and flanges to fit a wide range of application requirements.

• • •

Full information about all Hyatt Hy-Load Roller Bearings is contained in Catalog 547 . . . a complete engineering guide to radial bearing selection and use. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

Spot News

Short, "boiled-down" paragraphs on the most interesting recent events and developments in American industrial plants.

Large Vacuum Pans to Cook Down Syrup Installed in New Sugar Refinery Building

A new seven-story building, part of the projected $3,000,000 rehabilitation program of the Imperial Sugar Co. is under construction at Sugar Land, Texas. The view pictured here shows two of the three vacuum pans in place. The pans are of up-ended cylindrical construction and each is fitted with a row of seven "eyeglass port holes" spanning the height of the cylinder, for checking the level of the syrup

and massecuite (concentrated syrup containing sugar that has been crystallized). The extreme operating capacity of the vacuum pans is 1,000 cu ft each of boiling massecuite of 95% solids, for a total of 90,000 lb.

Inside each vacuum pan is a wrought iron calandria, a drum with tubes running between its heads. The calandria is the heating element of the vacuum pan. Steam circulates inside the drum and around the outside of the tubes, with the syrup inside the tubes and around the outside of the calandria. The heat of the steam is thus transferred to the syrup, boiling it down into concentrated massecuite.

Southwestern Ontario Begins 10-Year Changeover to 60-Cycle Current

The Canadian Hydro Electric Power Commission of Ontario will convert Southwestern Ontario's 25-cycle electric current to 60-cycle. The conversion will simplify procurement of industrial machinery and home appliances as most of this equipment is designed for the 60-cycle current to be installed. It will also permit an interchange of power between the United States and Quebec in time of emergency without the use of costly, elaborate frequency-changing equipment.

It has been estimated that the project will require about ten years to complete and will involve modifications to every sub-station in the area as well as the conversion of most electric motors in use.

"C" days are now being scheduled in the communities to be changed over. On these days the old power will be shut off while the conversion is made. This does not mean, however, that life will come to a standstill. Portable diesel-electric generators provided by the commission will be moved in, hooked up to the system and business will go on as usual.

TV Transmitter Installed on Rio's Sugar Loaf Via Cable Car in the "Wee" Hours

Television is coming to Rio this fall! Engineers of the International General Electric Co., who have been installing the transmitter on famed Sugar Loaf mountain in the harbor at Rio de Janeiro, Brazil, say their difficult job is now practically complete.

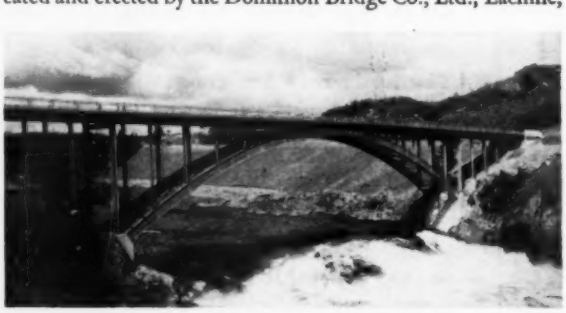
The transmitting equipment, several tons of it, including the 150-ft antenna, had to be hauled by cable car, mule back and by hand to the top of the 1,300 foot cliff.

Sugar Loaf's summit, which is inaccessible by automobile, is reached by cable car. Because of heavy tourist travel, the car has been available for use by the TV engineers only four hours a day from 4 to 8 a. m.

Brazil will be the first South American country to have regularly scheduled commercial programs and several thousand TV receivers may be in operation there by the end of the year, according to company officials.

First All-Aluminum Highway Bridge Completed in Quebec

The all-aluminum highway bridge at Arvida, Quebec, has recently been completed and opened to traffic. Fabricated and erected by the Dominion Bridge Co., Ltd., Lachine,



Quebec, and built for the city of Arvida, it is entirely of aluminum alloy and is believed to be the first structure of its kind in the world.

The bridge weighs approximately 495,000 lb less than would have been necessary for a comparable steel bridge and this reduction made for substantial savings in handling and freight charges.

UNLOADS COAL IN TWO MINUTES

Car shaker, shown in operation at the Buick plant in Flint, Mich., has shortened the time it takes to unload a carload of coal from 18 to two minutes. The device, weighing five tons, consists of an off-center flywheel turned by an electric motor. The flywheel vibrates car, shaking coal loose and letting it run out dump gates in bottom. Previously a crew of men had to climb into each car and loosen the coal with shovels. A steam crane moves shaker from car to car

New Lacquer Finishing Technique Exhibited at Paint Industries Show

A new lacquer finishing technique, a chemical resistant paint and synthetic resins manufactured under statistical quality control methods were featured in Hercules Powder Co.'s exhibit at the 1950 Paint Industries Show in Chicago, November 9-11.

The new lacquer finishing technique, the "hot-lacquer process", is attracting interest in the finishes field not only because of the economies it offers to the finishing industry but also because it by-passes the serious and ever-growing shortage of volatile ingredients. In the new process, heat is used instead of volatile lacquer ingredients to make the lacquer thin enough to spray.

The chemical resistant paint base on display was Parlon, chlorinated rubber, widely used in maintaining paints for both metal and concrete surfaces.

Country-Wide Service System Established for Fire Extinguishers

Organization of a nation-wide system with 180 depots in key cities has been completed by the Pyrene Manufacturing Co. of Newark, N. J. The services offered include immediate exchanges, replacement parts, repairs and trade-ins.

Certain extinguishers that can be repaired may be turned in for immediate replacement by the service depot with factory rebuilt extinguishers. Without this service the owner would either need to purchase extra extinguishers or be without this protection while the extinguishers were undergoing repair. This also assures him of factory-quality rebuilding service.

Common replacement parts for various types and sizes of soda-acid, foam and cartridge-operated water and antifreeze types are now carried in stock.

New "Ductulator" Simplifies Duct Sizing Problems for Fan Systems

Sizing ducts has always been a complicated problem for engineers, contractors and architects who are designing fan systems. In order to simplify this job, the Trane Co. has produced the Trane Ductulator which consolidates all of the charts on a simple, easy to use, multiple-scaled circular slide rule. An engineer can get all duct-sizing answers with a

(Continued on page 123)

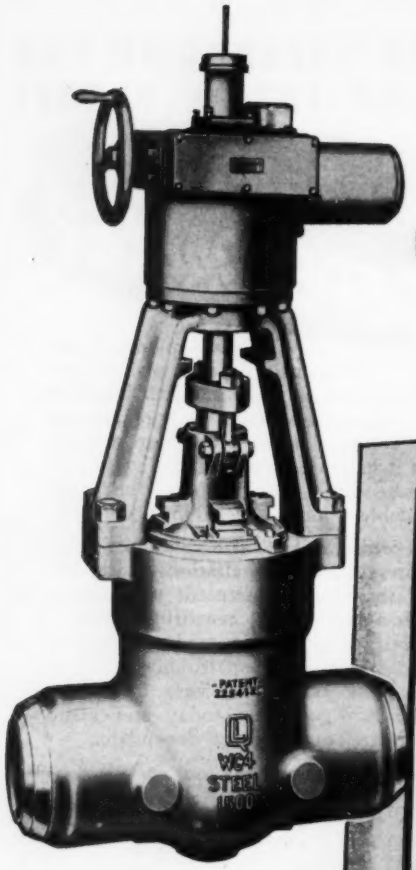
ONE PUMP BREAKDOWN CAN CRIPPLE AN ENTIRE PLANT!

Are your pumps **DEPENDABLE?**

In many plants, uninterrupted production depends on the continuous operation of *one* pump. If it breaks down — everything stops while repairs are made. Whole days of production may be lost if it has to be replaced. To avoid this expensive risk, employ only the most dependable pumps — WEINMAN.

Our representatives will be glad to size-up your present pump installations and to tell you if they are adequate for your needs. Each is a specialist in centrifugal pumps, their design, application, and installation. They can help you stop trouble before it starts. Why not write, wire or call a WEINMAN Specialist today and make sure that your pumps are dependable.

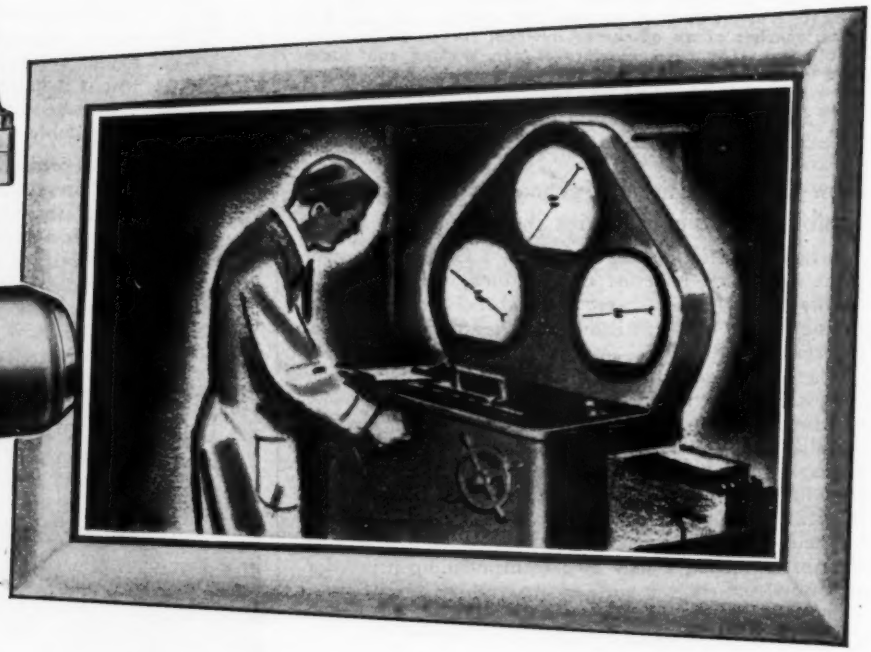
WEINMAN Type "U" Non-Clogging Pumps for liquids carrying solids. Capacities from 100 G.P.M. to 2000 G.P.M. Heads to 105 feet.
WEINMAN Type SS and ES pumps available with or without leak-proof mechanical shaft seals—capacities up to 1000 G.P.M. Heads up to 200 feet.
Representatives in Principal Cities
Built by Centrifugal Specialists
The WEINMAN Pump Mfg. Co.



Take advantage of

LUNKENHEIMER RESEARCH

IN CAST STEELS



The latest findings of Lunkenheimer's research division are available to *you*—to help solve *your* valve problems in power, petroleum, chemicals, or general industry. Lunkenheimer research in cast steels has been outstanding for more than 23 years.

Whether your service requirements are normal or severe, you will benefit from Lunkenheimer's latest research in welding, graphitization, new alloys, creep strength, and other subjects. They open up a fund of knowledge that gives you higher valve efficiency . . . safer operation . . . longer valve life.

The Lunkenheimer Sales Department will be glad to study your valve problems in the light of new research. Ask your local representative to show you the recent Lunkenheimer literature on Steel Valves, and write for further information to The Lunkenheimer Co., Box 360B, Cincinnati 14, Ohio.

STEEL • • • IRON • • • BRONZE

LUNKENHEIMER

THE ONE *Great* NAME IN VALVES

L-1150-7

SHEAVE ENGINEERING

ROBERT SUTHERIN, *Engineering Draftsman*

GETTING the correct machine speeds with V-belt drive sometimes requires a modification of stock sheaves. Quite often the proper combination of two sheaves, which would give the correct speed, is undesirable due to the lack of space.

Aside from production requirements, reasons for varying machine speed may be (1) union contracts, which sometimes specify maximum speeds of machines, and (2) to set up a performance chart to find the best speed to run a machine for lowest maintenance.

Perhaps the driven sheave is too large. Then, resorting to a different combination we still are unable to hit the required speed on the nose. A condition such as this can be eliminated by machining one of the old sheaves at much lower cost. Here is how.

Problem: The speed of a machine is 287 rpm. The motor speed (under load) is 850 rpm. The two sheaves are 16.0 P.D. (pitch diameter) and 5.4 P.D., 3 groove, *B* section. The machine must be slowed to 280 rpm.

Solution: If we were to buy the next stock size, 5.2 P.D., the new speed would be 276 rpm, which is unsatisfactory. To get the desired speed, we determine the new pitch diameter by:

$$\frac{X}{5.4} = \frac{280}{287} \text{ or, } 287X = 1{,}512$$

$$X = 5.268 \text{ P.D.}$$

Next, check Table 1 to find the proper groove angle, which happens to be 34 deg. in this case. Then by checking Table 2 we find that constant *K* is 0.0146 for a 34-deg. groove angle.

Now to find the exact amount to trim off each side of each groove to obtain the required speed, we merely substitute into the equation, $D = K\,(C)$.

$A = 5.4$, $B = 5.268$

$C = 10\,(5.4 - 5.268) = 10\,(0.132) = 1.32$

D = Amount to be trimmed off.

$D = 0.0146\,(1.32)$ or, $D = 0.0193$ in.

TABLE 2—ANGLE CONSTANTS

To alter pitch diameter by 0.10 in., remove the following amount from each side:

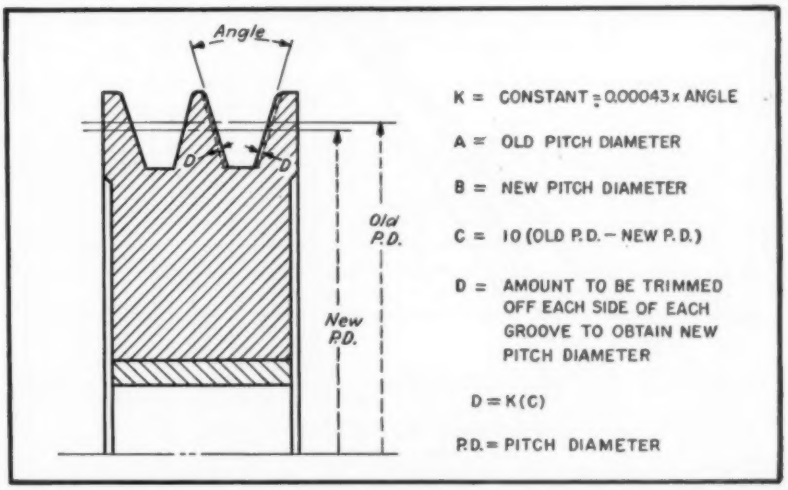
Angle, deg.	*Remove—K*
30	0.0129
32	0.0138
34	0.0146
36	0.0154
38	0.0163

This business of hitting speeds right on the nose is of minor importance on low-speed equipment. But on high-speed equipment, where 1 or 2 rpm over a period of time can mean a loss of thousands in production figures, it takes on new significance because of its effect on overall costs.

In sheave engineering there is one very important factor to consider, and that is the type of V-belt used, and its construction. Some V-belts, due to their particular construction, will not sit in the grooves and maintain the pitch diameters as they are machined. Thus, careful consideration should be given to any make of belts requiring a correction factor to obtain accurate drives. The charts and equations in this article do not apply when this type of V-belt is used on the power drive.

TABLE 1—GROOVE ANGLES

Belt Section	*Pitch Diameter*	*Groove angle, deg.*
A	Under 2.4	30
	2.4 to 2.99	32
	3.0 to 5.4	34
	Over 5.4	38
B	Under 3.6	30
	3.6 to 4.59	32
	4.6 to 7	34
	Over 7	38
C	Under 5	30
	5 to 5.99	32
	6 to 7.99	34
	8 to 12	36
	Over 12	38
D	Under 8	30
	8 to 9.99	32
	10 to 12.99	34
	13 to 17	36
	Over 17	38
E	Under 12	32
	12 to 15.99	34
	16 to 24	36
	Over 24	38


Angle
D
D
Old P.D.
New P.D.
K = CONSTANT = 0.00043 x ANGLE
A = OLD PITCH DIAMETER
B = NEW PITCH DIAMETER
C = 10 (OLD P.D. – NEW P.D.)
D = AMOUNT TO BE TRIMMED OFF EACH SIDE OF EACH GROOVE TO OBTAIN NEW PITCH DIAMETER
D = K(C)
P.D. = PITCH DIAMETER

Machine both sides of belt groove accurately to obtain correct pitch diameter

Plant Engineer's Handbook

HEATING WITH STEAM

WHEN steam coils are submerged in water and the condensate is withdrawn as fast as it forms, the rate of heat transfer may be determined from the graph below. Values for brass and iron pipe are based on data derived from tests and prepared by the American Radiator Co. Figures on the graph are one-half the actual test results, which allow for pipe corrosion and fouling.

Steam Traps. When the size of a steam trap is to be recommended, the pounds of steam condensed per square foot per hour, as given by the curves for the operating conditions, should be doubled. The following examples will show how to use the graph:

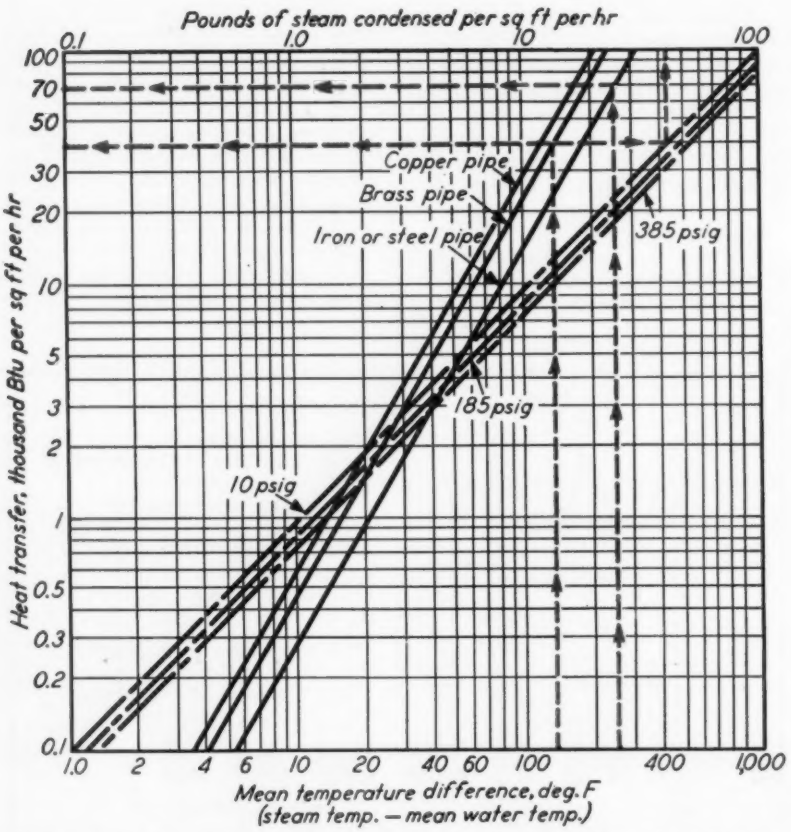
Example: A well insulated tank contains 10,000 gal of water, or 10,000 x 7.48=74,800 lb. Inlet water temperature is 70 F, and final temperature is 140 F. Steam temperature at 150 psig is 366 F. Pipe coil is made of 1¼-in. steel pipe.

Problem: How many feet of 1¼-in. steel pipe will be required to heat the water in one hour?

Solution: Determine the mean temperature difference thus:

$$\frac{(366-70)+(366-140)}{2}=261 \text{ F.}$$

Enter the graph on the bottom at 261 F, proceed upward to the line for steel pipe and then to the left ordinate to find the heat transfer rate of 70,000 Btu per square foot per hour. Then, 74,800 lb x (140—70)=5,236,000 Btu per hour needed to heat the water. Square feet of pipe surface needed is 5,236,000÷70,000=74.8. Since it takes 2.301 ft of 1¼-in. pipe to give one square foot of outer surface, 74.8 x 2.301=172.1 ft of pipe are needed.



Graph covers the range of steam pressure usually used to heat chemicals and water in process applications. Interpolation will give intermediate values needed

Example: Steam available is at 10 psig. Pipe is 2-in. standard brass. Inlet water is 40 F, and final temperature is to be 170 F.

Problem: Determine the number of Btu transferred, and the amount of steam condensed per square foot of pipe surface per hour.

Solution: The temperature of 10 psig steam is about 240 F. Mean water temperature is 105 F, which gives a mean temperature difference of 240—105=135 F.

Entering the bottom scale at 135 F, proceed up to the line for brass pipe. From here we go in two directions. Reading on the left ordinate gives us 40,000 Btu per square foot per hour, and proceeding right to the 10 psig line and then upward we find that 42 lb of steam are condensed by each square foot of outer pipe surface per hour.

Steam Flow in Pipes. To determine the velocity of steam in feet per minute through a pipe, use the quantity, pressure and area values.

Where:
V, velocity in fpm
A, lb of steam per hr
B, steam volume, cu ft per lb
C, pipe area, sq in
1728 cu in. a cu ft
60 min in one hr
12 in. in one ft

Then:

$$V=\frac{A\times B\times 1728}{60\times C\times 12}=\frac{A\times B\times 2.4}{C}$$

$$A=\frac{C\times V}{A\times 2.4}$$

$$B=\frac{C\times V}{A\times 2.4}$$

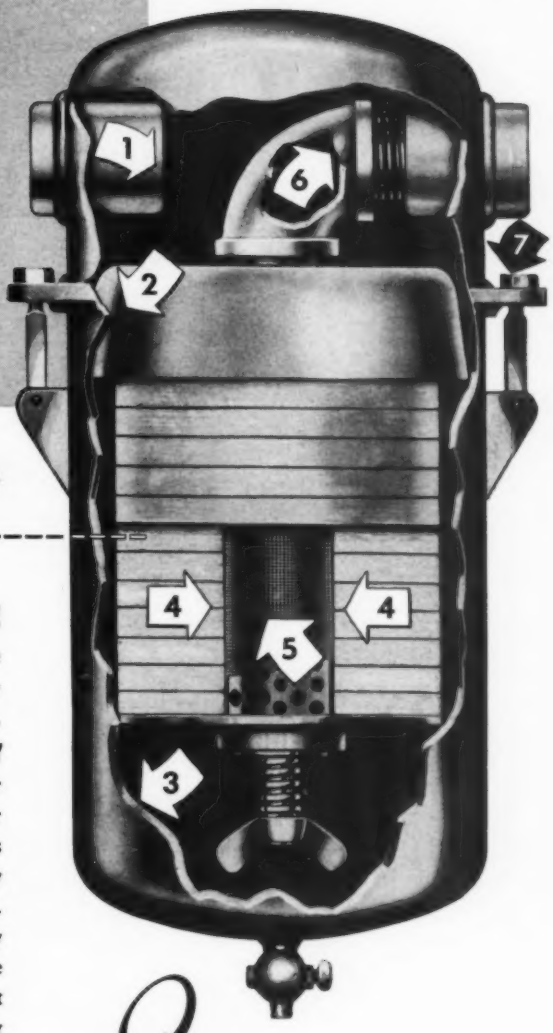
$$C=\frac{A\times B\times 2.4}{V}$$

Pressure Loss. The above equations do not consider the probable drop, or loss of pressure, which depends upon the velocity of flow, length of line, number of turns in fittings or valves, and the pipe insulation. In every steam line there must be a difference in pressure between the inlet and outlet, or there could be no flow, and this difference is increased by friction and radiation. *Courtesy of Crane Co.*

ROLLER CONVEYERS

Third paragraph of the November Notebook should read: "On a downward incline, a gravity roller conveyer may be better, but the pieces handled should not be heavy enough to sag between rollers. There are limits to the down grade; if it is too steep, the loads gain too much speed, and if too flat they will not coast."

Removes Last Traces of Oil and Moisture from *COMPRESSED AIR LINES*



THICK FELT DISCS PROVIDE SUPER FILTRATION

DOUBLE ACTION PRINCIPLE REMOVES MOISTURE AND DIRT TWO WAYS—Here's the greatest pipe line filter ever developed for removal of every trace of foreign matter, condensed oil and moisture. Compressed air is cleaned by both *mechanical separation* and *filtration/absorption.* Air entering filter inlet (1) strikes Deflector Cup (2) by which heavier droplets of water and dirt particles are directed to sides of Housing (3) and thence downward at high velocity to base where liquid and heavier particles are deposited. The *mechanically cleaned* air then passes at low velocity thru the Discs (4) which *filter* the air and *absorb* the last traces of oil and moisture. Clean, dry air passes out thru fine mesh Bronze Screen (5) and Outlet (6). Swing Bolts (7) on head for easy inspection are optional.

Originally designed for the protection of pneumatically operated control apparatus, these revolutionary filters are now used as a primary or final stage of filtration for an ever-increasing number of tools, devices and processes. Many highly successful installations are reported in which no other filter had proven satisfactory.

Request Bulletin B-1A, mentioning problem involved for specific engineering information. Please direct your inquiry to Dept. 46.

Staynew

ABSORPTION FILTER

A complete range of sizes available, handling capacities from 5 to 100 CFM free air at 80 lbs. gauge pressure in standard pipe sizes from ¼" to 2". Model illustrated is AAPHS (swing-bolt head). Available also is Model AAPH, identical except for bolted-head construction.

DOLLINGER REG PROTECTOMOTOR U.S. PAT. OFF. STAYNEW FILTERS

DOLLINGER CORPORATION
11 CENTRE PK., ROCHESTER 3, N. Y.

readers' guide to advertised products

Here you'll find, briefly reviewed, all the booklets and leaflets offered in the advertising columns of this issue of INDUSTRY AND POWER. For easy reference, this listing is divided into various classifications of products. To get your free copies of literature described here and in the corresponding advertisements, turn to Page 101 for a postage-free order card. There, list the Key Numbers of the paragraphs below and mail.

BOILER & FURNACE CONSTRUCTION UNITS

1—See page 37. Packaged Steam Generators: New, fully illustrated Catalog 202 gives complete details for units available in 17 sizes. Write today. Superior Combustion Industries, Inc.

2—See page 43. Preferred Unit Steam Generator: Check the important features of Preferred Unit Steam Generators that assure efficient economical service for an average of 25 years. Write for Bulletin 1000 today. Preferred Utilities Mfg. Corp.

3—See page 108. Low Cost Steam: Data describes a boiler available in 6 sizes—6 to 36 hp. Economical to buy and operate. 6" scale with pipe diameter markings also sent upon request. Kewanee Boiler Corp.

4—See page 25. Dual Circulation Steam Generators: Send for your copy of Bulletin B-50-11. Covers principles and advantages of Dual Circulation. Steam generators for power and process steam of super purity. Write today. Foster Wheeler Corporation.

5—See page 135. Steam Generators: Wickes gives you a complete line of steam generation equipment plus full help in solving your problems of steam generation. Write for descriptive literature. Wickes Boiler Co.

6—See page 133. Gas Stand-By Plants: LP Gas Stand-By Plants start immediately, operate efficiently, interchangeable with present gas. Protect vital production during normal fuel shortage. Write for full particulars. H. Emerson Thomas & Associates, Inc.

WATER TREATMENT

7—See page 9. Filming Amines: Send for Technical Paper #121, "How Filming Amines Prevent Steam and Return Line Corrosion". Achieves as high as 99 percent reduction in corrosion rate! Write today. W. H. & L. D. Betz.

8—See page 124. Versene Test Kit: Lets you test the hardness of water in your plant in less than two minutes. Includes enough chemical to make more than 50 separate tests. Refills available. Full directions in each kit. Write today. Bersworth Chemical Company.

9—See page 120. Water Treatment: Write for detailed information about solving your water treatment problems. This complete service includes each step from original survey of problem to installation of water purification equipment. General Filter Co.

10—See page 6. Boiler Water Comparators: Low cost, extreme accuracy, simple operation make Taylor Comparators ideal instruments for all plants. Write for free booklet. W. A. Taylor and Co.

11—See page 129. Water Treating Equipment: Get your copy of fact-filled bulletins giving complete data of manual or automatic equipment in all sizes, types and capacities. Hungerford & Terry, Inc.

12—See page 97. Water Conditioning System: Write for full facts concerning this system that gives you all the heating, chemical feeding and clarification facilities for optimum water conditioning results. Ask for Bulletin W-212-B2. Worthington Pump and Machinery Corp.

13—See page 49. Water Softeners: Be sure to write today for facts on how you can modernize your present water softening system with Elgin Double-Check manifolds at maximum savings. Elgin Softener Corporation.

CLEANERS AND BLOWERS

14—See page 129. Combination Blower-Suction Cleaner: It's a snap to rid all of your equipment of damaging dirt, dust, and grit with this portable cleaning tool. Write for more data. Clements Mfg. Co.

COMPRESSORS

4—See page 39. O-CE Air Compressors: Write for Bulletin 726-5 covering these motor-driven compressors in sizes up to 2000 hp — first horizontal duples, side crank compressors to have anti-friction roller bearings throughout. Chicago Pneumatic Tool Company.

16—See page 121. Air Compressors: Write today for Bulletin P-10. Gives complete details on conveying of energy. Schramm compressors insure worthwhile profits. Schramm, Inc.

DIESEL POWER

17—See page 2. Diesel Engines: For a complete line of engines of the type and size to meet your requirements exactly, write for details on Superior-Atlas line. The National Supply Company.

18—See page 7. Diesel Engines: Write for details on how Nordberg Diesels, in sizes from 10 to 9600 hp solve your power generation problems at major cost reductions. Nordberg Mfg. Co.

DUST & FLY ASH COLLECTION EQUIPMENT

19—See page 112. Dust Control: Check the ways Dracco Dust Control can save you money and write for full information on how Dracco results in increased efficiency. Write today. Dracco Corporation.

20—See page 17. Dust & Fume Control Systems: Kirk & Blum experts can design and install a complete dust or fume control system for your plant that will solve your problems. Write for Booklet. Kirk and Blum Mfg. Company.

21—See page 33. Fly Ash Collector: 'LR' Fly Ash Collector designed especially for small boilers—collects 99% of all 100-mesh cinder discharge. Fits small plant's boiler room. No cleaning, no water. Write for complete facts. Buell Engineering Company.

ELECTRICAL EQUIPMENT

22—See page 32. Magnetic Starters: Write for Free Folder G-7005 on Arrow-Hart magnetic starters. High arc resistance, ease of wire and servicing, balanced mechanism cuts space in half. The Arrow-Hart & Hegeman Electric Co

FLOOR REPAIRS

23—See page 128. Floor Resurfacer: You can resurface or patch broken concrete floors with tough "Ruggedwear" resurfacer. Makes durable patch or complete overlay. Simple to install, no chopping or chipping required. Use indoors or out. Quick dry. Send coupon or write for complete Handbook of Building Maintenance. Flexrock Company.

FUELS AND FIRING EQUIPMENT

24—See page 104. Fuel Oil Additive: Houghto-Solv dissolves all the sludge in your entire system—cleans tanks, lines, strainers, pumps, nozzles, etc. Write for free descriptive folder today. E. F. Houghton & Co.

25—See page 13. Combination Gas & Oil Burner: The new John Zinc VCBM 2-0 offers you 11 major features—study them on page 13. There's a John Zinc burner for every heating and power need. Write for complete literature. John Zinc Company.

26—See pages 40, 41. Pulverizers: Tungsten carbide facings on pulverizer parts give you much longer life, greatly reduce maintenance costs, insure sustained fineness of pulverization. Write today for further information. Riley Stoker Corporation.

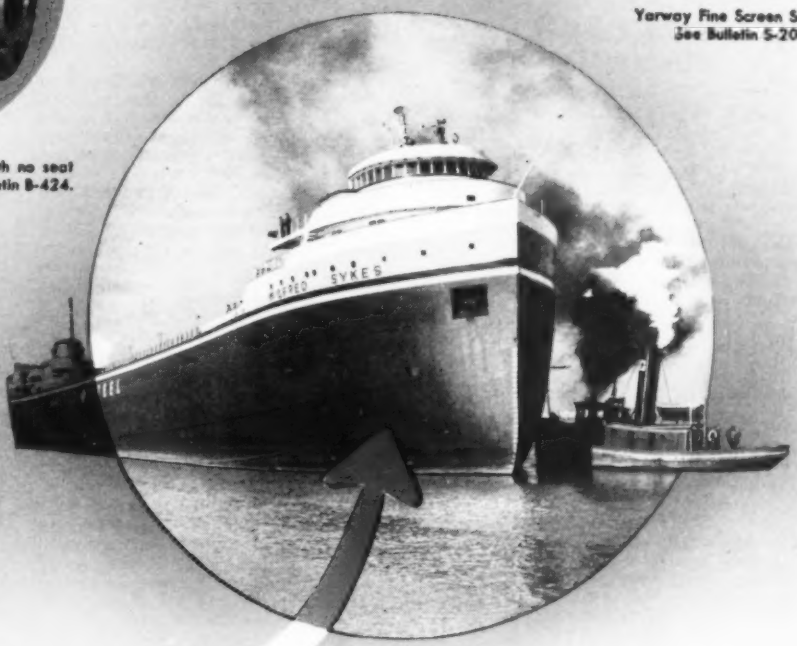
(Continued on page 96)

W

Yarway Impulse Steam Trap. Also available with integral strainer. See Bulletin T-1739.

Yarway Fine Screen Strainer. See Bulletin S-203.

Yarway Seatless Blow-Off Valve, with no seat to score, wear, clog, or leak. See Bulletin B-424.



Yarway Remote Liquid Level Indicator for water level or pressure differential indication. See Bulletin WG-1823.

the WILFRED SYKES" *signs on a Yarway Crew*

When the "Wilfred Sykes," largest ship on the Great Lakes, went into service recently, she was fitted out with four kinds of Yarway steam plant equipment.

The engineers who designed this newest and greatest of Inland Steel Company's freighters, selected Yarway Remote Liquid Level Indicators, Seatless Blow-Off Valves, Impulse Steam Traps, and Fine Screen Strainers.

Just as dependable for marine use as they are in thousands of steam plant installations across the land, these Yarway products are helping this Great Lakes ship set new records in her ore-carrying runs from Duluth to Indiana Harbor.

If you're looking for the kind of service in your plant that marine engineers *must* have in theirs, check on these Yarway products. There's a Yarway office near you, or write direct for the product bulletins you want.

YARNALL-WARING COMPANY

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YARWAY

STEAM PLANT EQUIPMENT

readers' guide to advertised products

(Continued from page 94)

27—See page 11. Fanmix Burners: Bulletin 410-6 will give you complete data on Coppus-Dennis Fanmix Burners that increase boiler ratings with your present furnace and stack. Write today. Coppus Engineering Corp.

INSTRUMENTS

28—See page 130. Ernstilt Adjustable Inclined Column: Write for Bulletin T-1. Contains specifications of this adjustable inclined column designed for package type boilers up to 300 lbs. W.S.P. Ernst Water Column & Gage Co.

29—See page 124. Automatic Liquid Measuring Gages: Write for complete details on liquid level gages for measuring liquids of all kinds. Dial readings in feet, inches, gallons, pounds or any desired units. The Liquidometer Corp.

30—See page 115. All-Metal Thermometers: Write for complete data on these easy-to-read, ruggedly constructed thermometers for most industrial applications. Wide variety of types. Weston Electrical Instrument Corporation.

31—See page 127. CO_2 Indicator: You can check for carbon in flue gas easily and quickly with the Fyrite. Write for free Bulletin 740 for full description of this accurate, dependable index of combustion efficiency. Bacharach Industrial Instrument Co.

32—See page 118. Flow Indicators: Henszey indicators have only three moving parts! This means longer wear, continued service and constant accuracy. Write for full details. Henszey Company.

33—See page 116. Analysers: Send coupon for Bulletin 800-A on Gas Analysis. Data-packed pages have wide range of gas and analysis problems and their solutions. Charles Engelhard, Inc.

LUBRICANTS AND FILTERS: PURIFIERS AND LUBRICATORS

34—See page 114. Non-Fluid Oil: Send for instructive bulletin and free testing sample of Non-Fluid Oil for positive bearing protection. New York & New Jersey Lubricant Company.

35—See page 127. Spray Valve: Farval Bulletin No. 60 will bring you complete data on the new Farval Spray Valve that meters lubricants to slide surfaces and open gearing. Write today. Farval Corporation.

36—See pages 44, 45. Turbine Oil: Ask for more information about Sinturlite, which is non-foaming, non-corrosive, and separates readily from water. Sinclair Refining Co.

37—See page 16. Lubriplate: Write today for authentic information on how these lubricants effect maximum savings even in unusually severe lubrication problems. Fiske Brothers Refining Company, Lubriplate Division.

38—See page 85. Lubricants. Sunvis H.D. 700 Oils keep circulating systems clean. These oils will free oil lines and bearings of foreign matter, too. They loosen up and carry away accumulation of dirt, carbon, water, or other contaminants. For complete information on Sunvis H.D. 700 Oils write for Booklet IP-12. Sun Oil Company.

39—See pages 35, 36. Industrial Oil: Now, new Stanoil offers longer oil life and greater protection against rust than ever before. Write for data. Send, too, for new booklet on Stanolith Greases. Standard Oil Co. (Indiana).

MAINTENANCE

40—See page 127. Free Repair Handbook: Filled with time-saving, money-saving uses for Smooth-On in plants and shops. Clear, practical directions. 170 illustrations. Send today for your copy. Smooth-On Mfg. Co.

41—See page 47. Rust Preventive: Rust-Oleum seals metal so that no rust-causing oxygen can reach it. Available in a full range of colors. Write for complete catalog. Rust-Oleum Corporation.

42—See page 132. Maintenance Equipment: Write for free 40-page handbook on Commutator and Slip Ring Maintenance and full information on resurfacers, precision grinders, undercutters, flexible abrasive. Send coupon today. Ideal Industries.

MATERIAL HANDLING

43—See page 129, Snatch Blocks: WECO Snatch Blocks have self-lubricated bearing, drop side for easy stringing and unstringing, forged steel hook and sheave for maximum strength. Write for bulletin. Well Equipment Mfg. Corp.

PACKINGS AND GASKETS

44—See page 109. Navalon Packings: Made of "ramie", these packings give service against fresh or salt water, brine, cold oil, and for use on pumps, elevators, etc. Write for Folder PK-32A. Johns-Manville.

45—See page 20. High Pressure Packings: Send coupon for R/M Catalog with complete data on these high-pressure packings especially built for tough jobs. Raybestos-Manhattan, Inc., Packing Division.

46—See page 106. Quality Packings: Outstanding quality and maximum service is the insurance you get with "John Crane" line of packings. Write for complete details. Crane Packing Company.

PIPE AND FITTINGS

47—See page 100. Flexible Metal Tubing and Metal Hose: Write for literature describing the many uses and types for handling steam, water, oil, solutions, semi-solids, or gases. American Metal Hose Branch, The American Brass Company.

For your free copies of this new literature and more data on advertised products, list the key numbers of the descriptive paragraphs on one of the handy order cards, page 101. Mail today—postage-free!

48—See page 114. Pipe Fabricating Specialists: Meet your most exacting specification with absolute satisfaction on all pipe fabricating for Oil, Chemical, Concrete, Asphalt, and other industrial requirements. Albert Pipe Supply Co., Inc.

49—See page 15. Copper Tubes: Copper is the answer to any industrial application where rust is to be avoided. Anaconda Copper Tubes are busy serving industry in thousands of different ways. The American Brass Company.

50—See page 119. Pipe Unions: Bronze-to-bronze ball joints insure long life and tight joints. Because of precision in manufacture these unions can be disconnected and reinstalled many times. Send for complete information today. E. M. Dart Mfg. Co.

51—See page 134. Flexible Metal Hose: Write for data sheets on CMH Rex-Tube Type RT-15. This flexible metal hose economically and dependably conveys steam, tar, asphalt, vegetable oil, hydrocarbons or similar substances. Write today. Chicago Metal Hose Corporation.

52—See page 122. Pipe Cutters: Write for free catalog of complete data on these outstanding values in pipe tools. Armstrong Bros. Tool Co.

53—See page 31. B & W Tubes: Write for new Bulletin T B 329 for full information on seamless and welded heat exchanger and condenser tubes. The Babcock & Wilcox Tube Company.

PLANT EQUIPMENT

54—See page 125. Steel Work Bench: Send today for Bulletin 702—complete details for this all-steel constructed, finest quality cabinet bench. Standard Pressed Steel Co.

55—See page 122. Steel Grating: Bulletin KA 114 fully describes the Dravo line of Tri-lok grating, safety treads, open steel flooring, concrete armoring and other products. Send for your free copy. Dravo Corporation.

POWER TRANSMISSION

56—See page 110. Motor Couplings: Ask for Catalog 57 which gives full details, ratings, and service factors for gear-type, all-steel couplings. John Waldron Corporation.

57—See page 126. Worm-Gear Sets and Speed Reducers: Write for latest Cleveland Catalog of Cleveland's complete line. They'll meet the needs of any machinery or equipment builder or user. Be sure to outline your requirements. The Cleveland Worm & Gear Company.

58—See page 87. Roller Bearings: Hyatt Hy-Loads provide high load capacity, long life in shaft location. Catalog 547 gives full information on all ten types of Hyatt Hy-Loads. Write for your copy today. Hyatt Bearings Division, General Motors Corporation.

59—See page 3. V-Belts: Ask Goodyear about HY-T Multi-V-Belts for normal speed, heavy shock-load drives; Goodyear also features other V-Belt constructions to meet specific drive demands. Write for details. The Goodyear Tire & Rubber Co.

(Continued on page 101)

No Other Water Conditioning System Has All of These Features...

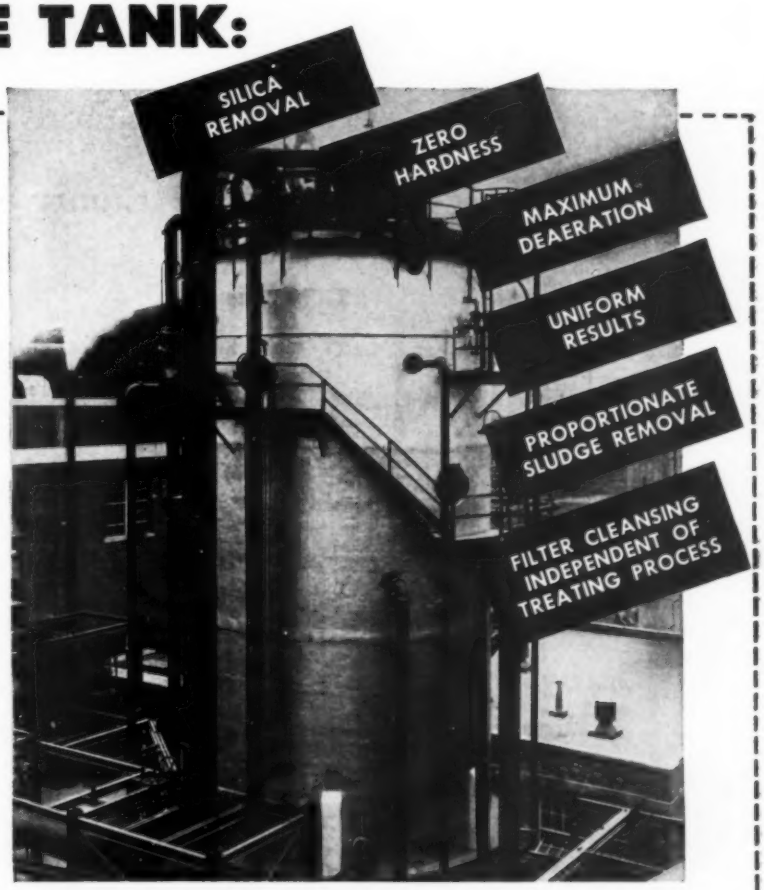
...ALL IN ONE TANK:

YES, you get all these and more, too, in one tank without the aid of internal mechanical agitation or other moving parts when a water conditioner like this 900,000 lb. per hour Worthington installation treats your make-up or condensate water.

In less space you get all the heating, chemical feeding and clarification facilities to provide optimum water conditioning results. Worthington's engineering skill and complete manufacturing facilities offer you the advantages which can only result from carefully coordinated effort under one responsibility.

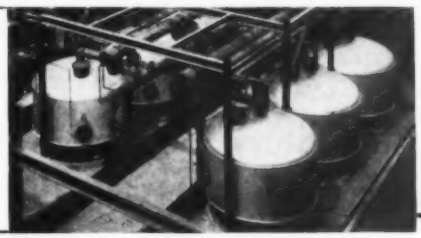
WRITE FOR FACTS

For proof that, in water conditioning as in so many other services, *there's more worth in Worthington*, write for Bulletin W-212-B2. *Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, N. J.*



Main treating tank of a Worthington Hot Process Water Conditioning System, capacity 900,000 lb. of treated water per hour

Six pressure filters 11 feet in diameter used for final clarification in this Worthington Hot Process Water Conditioning System



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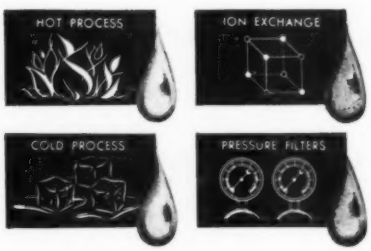

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WATER CONDITIONING

Worthington Makes More of the Equipment For All Types of Water Conditioning Systems

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with the American Cyanamid Story

An exclusive 52 page report of outstanding significance to you.

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Written by -- and for -- executives and engineers of the Plant Engineering Group.

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Proudly presented as a document of importance by the Editors of INDUSTRY AND POWER, working in cooperation with American Cyanamid engineers.

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as usual, your regular January copy of INDUSTRY AND POWER, containing the American Cyanamid Story. If you want extra copies of this valuable issue for the individual use and reference of others in your Plant Engineering Group, please order at once. First come, first served.

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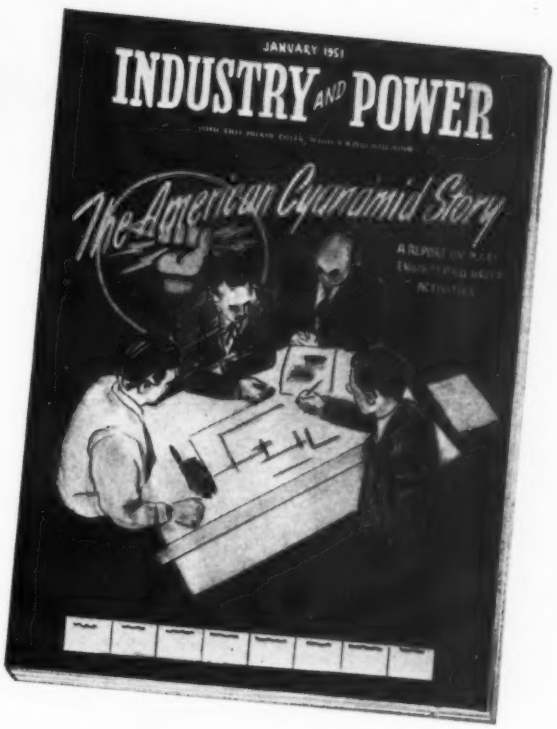

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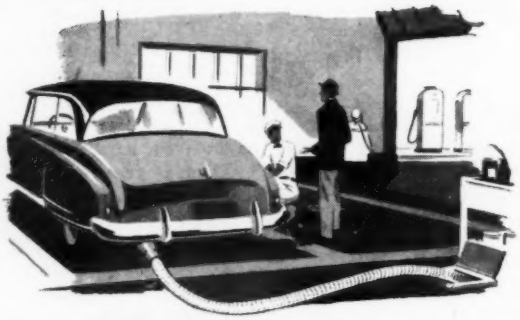
Variety

is the spice of an American flexible connector's life!

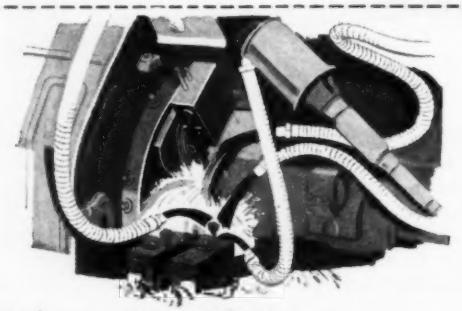
Bakers' baby

Believe it or not, this machine forms rolls out of dough. Yep, it's a Readco Vacuum Roll Divider and Rounder. In goes the dough—out come the rolls, ready to bake. American Seamless Flexible Bronze Tubing carries the vacuum—which shows that this famous tubing is equally good for carrying "nothing."



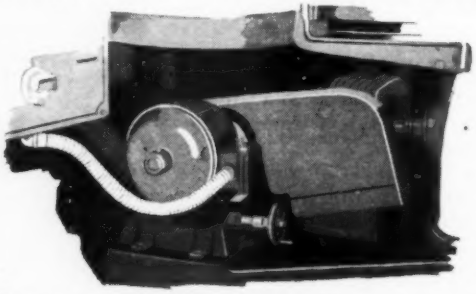
Deadly "CO" has to go

Yes, deadly carbon monoxide is carried off safely by this "Monoxivent" exhaust system, built by the Kent-Moore Organization, Inc. American VAC Type Flexible Stainless Steel Tubing, dependably tight and resistant to rust, heat and corrosion, handily connects the car exhaust to the underfloor duct.



Metal-working robot

With uncanny precision and "intelligence" this automatic lathe installed at The Black & Decker Mfg. Co. puts the bite on metal rod while this American Flexible Coolant Line carries oil to the tool edge. To remove damaging particles of metals, the cutting oils and coolants are clarified by a DeLaval Purifier.



This machine can can

Anyway, it can can as long as the motor can. In use at The California Packing Corporation, it's a disc feeder which automatically feeds cans into a fruit canning production line. The motor feed wires are safely tucked away in American Sealtite* Conduit which protects the wires while providing flexibility for belt take-up.

*Trade Mark

THERE'S a type of American Flexible Metal Hose or Tubing for conveying liquids, many chemicals, gases and semisolids under severe conditions of temperature, pressure and frequent movement . . . for protecting wiring and flexible drive shafts . . . for absorbing vibration . . . for connecting misaligned piping and ports. Let us tell you about them in full detail. The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Co., Ltd.

50240

wherever connectors must move

ANACONDA
from mine to consumer

American

FLEXIBLE METAL HOSE AND TUBING

reader's guide to advertised products

(Continued from page 96)

PUMPS

60—See page 105. Pumps: Warren Pumps contribute to peak dependability and efficiency, long life and low maintenance, with special emphasis on safety. Write for Bulletins 241 and 244 for complete details on Warren Pumps for high pressure services. Warren Steam Pump Company, Inc.

61—See page 126. Aurora Pump: Type-OD Aurora centrifugal pump features horizontally split-case, double suction. For general water supply in municipalities, industries, office buildings — also for handling liquids, chemical solutions, oil, etc. Write for Bulletin 105-M for complete details. Aurora Pump Company.

62—See page 27. Centrifugal Pumps: Write for latest Bulletin on Worthington Centrifugal Pumps. More than 10,000 standard combinations of capacities, heads, casings and mountings insure the right pump for you. Worthington Pump and Machinery Corp., Pump and Compressor Merchandising Div.

63—See page 89. Weinman Pumps: They work at maximum efficiency on every job. If your plant handles liquids in any form, it will pay you to talk with Weinman. Write today for complete data. The Weinman Pump Company.

REFRACTORIES

64—See page 120. Boiler Seam Protector: Free bulletin describes this protector that stops warpage and oxidation of lapped edges; averts leaking, calking, patching. Write today. National Boiler Protector Co.

65—See page 125. Refractory Cement: Super-Moldit triples life of boiler burner blocks. They cut replacement costs in half. Moldit comes in several types of various boiler refractory parts. Write for free bulletin. Refractory & Insulation Corp.

REGULATORS AND CONTROLS

66—See page 128. Regulators and Thermometers: Bulletins 500 and 1000 give you full data on regulators and thermometers that will cut your processing cost to a new low. H. O. Trerice Co.

67—See page 107. Pressure and Temperature Regulators: Write for Bulletin 350. Spence gives full data on Spence Regulators. They operate at low unit stress for long life, cut down maintenance cost. Spence Engineering Company, Inc.

68—See page 126. Temperature Regulators: Write for Stacon Bulletin 50-1000 for full details on extra sensitive, accurate, economical temperature regulators. Farris Stacon Corporation.

69—See page 124. Mercury Switches: Write for further information on these switches that are not affected by dust, dirt or corrosion. Let Mercoid solve your control problems. Further information sent upon request. The Mercoid Corporation.

70—See page 28. Valve Tops: Powers Flowrite Valves control flow of steam, water, oil and gases. Metaflow are for use in control applications where pressure differential does not exceed 75 lbs. psi. Write for full details. The Powers Regulator Co.

71—See page 4. Controls: Write Hays Corporation for information on complete line of flow meters, controls, draft gages, gas analysis, instruments. Hays Corporation.

STEAM TURBINES AND ENGINES

72—See page 46. Power Saving Turbines: Eight-page Bulletin S-116 illustrates and describes application, construction, savings effected and advantages of the Terry solid wheel turbine. Write for your copy now. The Terry Steam Turbine Co.

TOOLS AND SMALL SPECIALTIES

73—See page 113. Tube Cleaners and Expanders: Write today for complete information on Airetool cleaners and expanders for every type of tubular contsruction. Airetool Manufacturing Co.

74—See page 117. Tube Cleaners: The new Rotojet removes scale so fast it actually pays for itself in one cleaning. Models available for practically any size tubes. Send for Rotojet Bulletin. Elliott Company — Roto Division.

TRAPS, STRAINERS AND SEPARATORS

75—See page 21. Impulse Steam Traps: To get equipment hot and into production faster, use Yarway impulse steam traps. Write for full information on

Use these postage-free cards to order booklets and catalogs from advertisers, new bulletins and new equipment literature. List key numbers or letters of the paragraphs describing the items you want in the spaces provided on cards.

To: INDUSTRY AND POWER, St. Joseph, Michigan **December, 1950**

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Advertised Products Numbers begins Page 94	*New Equipment Numbers begins Page 8*	*New Bulletin Letters begins Page 24*

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how these traps keep equipment continuously at peak operating temperatures. Yarnall-Waring Company.

76—See page 93. Pipe Line Filters: Staynew Double Action Pipe Line Filter's guarantee, in one unit, plus performance—mechanical separation and filtration. Write for Bulletin B-1A. Dollinger Corp.

77—See page 19. Thermostatic Steam Trap: Sarco No. 9 insures quick starts and steam economy. You can use it extensively for process tanks, steam lines, radiators and wall coils, tracer lines and outdoor applications. Write for free Catalog No. 250-A. Sarco Company, Inc.

78—See page 136. Steam Traps: Super-Silvertops save you money in two ways—cut down installation costs and keep operating costs low. Write for helpful book, "Solving Steam Trap Problems." The V. D. Anderson Company.

79—See page 95. Impulse Steam Traps: To get equipment hot and into production faster, use Yarway impulse steam traps. Write for full information on how these traps keep equipment continuously at peak operating temperatures. Yarnall-Waring Company.

80—See page 123. Thermostatic Traps: For trapping instrument sterilizers, water stills, coffee urns, warming tables and similar equipment—use Illinois. Write for free literature. Illinois Engineering Co.

VALVES

81—See page 90. Steel Valves: For complete steel valve data, write today. Lunkenheimer steel valves have outstanding records of safety and long service due to metal quality and careful workmanship. The Lunkenheimer Co.

82—See page 111. All Iron Gate Valves: Made of high-test alloy iron to withstand the action of many of the strongest chemicals. Low maintenance cost, easy operation, long service. For full details write today. The Fairbanks Company.

83—See page 130. Valves: Write for full information on Everlasting Valves that insure clog-free operation, keeps viscous materials flowing freely. Everlasting Valve Co.

84—See page 128. Air Control Valves: Bulletin "A-P" gives full description of Valvair's 2-way, 3-way and 4-way air controlled valves featuring maximum dependability. Write today. Valvair Corporation.

85—See page 42. Crane Valves: Dependable quality Crane valves insure low maintenance costs. Ask your Crane representative for a demonstration or write for full details. Crane Co.

86—See pages 50, 51. Blow-Off Valves: Unit Tandem Blow-Off Valves constructed with special strength and toughness to withstand severest blowdown conditions. Write for Bulletin B-433. Bulletin B-424 describes lower pressure blow-off valves. Yarnall-Waring Company.

87—See page 123. Rockwell Valves: Feature hydraulic control for shut-off and throttling of air, gases, steam, liquids, semi-solids. Butterfly and slide tyes—any type manual or automatic control. Write for catalog. W. S. Rockwell Company.

88—See page 52. Slotted Wedge Cast Steel Gate Valve: Darling gate valves are made in wide range of sizes, types and constructions and for pressures up to 1500 lbs. Write for bulletin. Darling Valve & Manufacturing Co.

89—See page 38. Chapman Valves: There's a Chapman Valve to meet every pressure or temperature range. Available in flanged, welded, or pressure sealed body and bonnet connections. Write for further details. The Chapman Valve Manufacturing Company.

90—See page 30. Chrome-Moly Valves: Write for new Catalog F-9. 400 pages cover complete Vogt line of drop forged steel valves, fittings and flanges for steam, water, oil, gas, air and refrigeration services. Send today. Henry Vogt Machine Co.

91—See page 125. Airtight Valves: These valves are noted for airtight, drip-free closures on any flow. Models for manual or remote control—1-way to 5-way. Write for free catalog. DeZurik Shower Co.

WELDING EQUIPMENT

92—See page 48. Cutting Attachments: For trimming, shaping, beveling, groove-cutting—Prest-O-Weld cutting attachments give you maximum performance. Attachment and heads fit same blowpipe handle. Write for details. Linde Air Products Company.

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Your Name_____ **Title**_____

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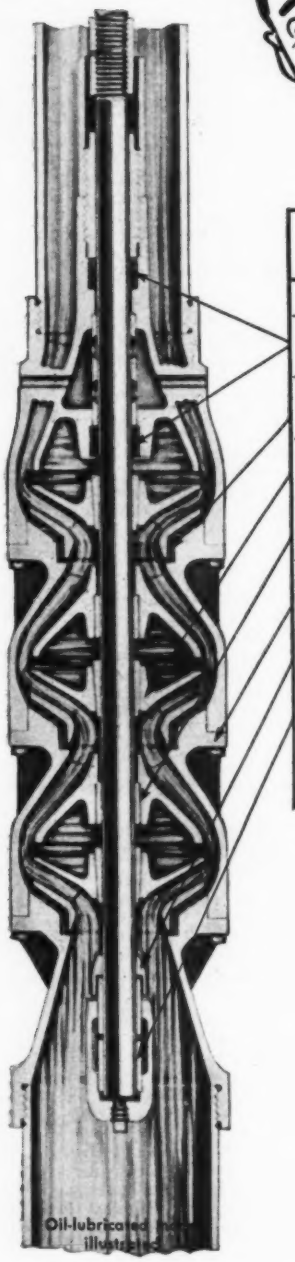
Before you buy a vertical turbine pump

CHECK WORTHINGTON AGAINST THE FIELD!

Chart shows only Worthington gives you all 8 vital design-features as standard equipment



The Ten Leading Makes Of Vertical Turbine Pumps
√ Indicates Feature Is Standard

Standard Features	Worthington Type Q	Pump A	Pump B	Pump C	Pump D	Pump E	Pump F	Pump G	Pump H	Pump I
Seals above and below drain parts (oil-lubricated model)	√									
Wearing rings	√				√			√		
Enclosed impellers	√	√	√	√	√	√		√	√	√
Bronze bushings in bowl assembly	√		√	√	√	√		√	√	√
Flanged and bolted bowls on all sizes	√						√		√	√
Sand collars at both ends of bowl assembly (water-lubricated model)	√	√								
Grease-packed bottom bearing	√	√			√					√
Choice of oil or water lubrication	√	√	√	√	√	√		√		

There's your quick, complete picture of how Worthington Type Q stocks up against competition. Remember — each of the features listed is a proved aid to more efficient pump performance. And only Worthington gives you all of them as standard!

Why settle for anything less than this all-inclusive, ahead-of-the-parade design that assures smoother, lower-cost pumping?

Maximum Head In All Sizes

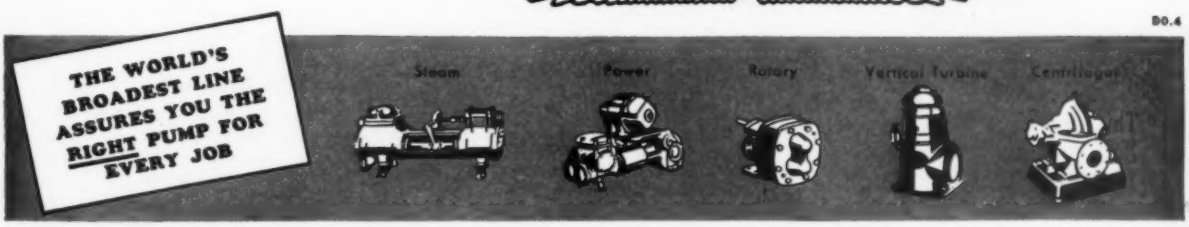
Available in sizes from 6" to 32", Worthington Type Q Vertical Turbine Pumps handle liquids at temperatures of 7° below zero F to 500°F, with maximum head per stage over the entire size range.

See your local Worthington dealer for the whole story that proves *there's more worth in Worthington.* Complete manufacturing and servicing facilities at Denver, Colo., and Harrison, N. J. *Worthington Pump and Machinery Corporation, Harrison, N. J., Denver 16, Colorado.*

Dealer Franchises Open

WORTHINGTON

80.4



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to remove sludge

. . . and in each case users gain not only higher heating efficiency but also sizable savings *in hard cash!*

Messy, laborious sludge cleaning jobs have been eliminated . . . for example, nearly $2,000 was saved in just one instance by the application of Houghto-Solv.

This industrial fuel oil additive dissolves *all* the sludge in your entire system. It cleans tanks, lines, strainers, pumps, nozzles, etc. Simply add one quart per 1,000 gallons of fuel oil. Results come quick!

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303 W. Lehigh Ave.
Philadelphia 33, Pa.

This free folder is helpful
Write, or call the Houghton Man, for this descriptive folder which gives complete data on this speedy fuel oil solvent.

MEETINGS and EXHIBITIONS

Highlights of coming meetings that will aid executives and engineers in planning itineraries. For additional information, please write sponsors of meetings

JANUARY

Plant Maintenance Show—and concurrent conference on maintenance techniques will be held in Cleveland, January 15 to 18. Clapp & Poliak, Inc., 341 Madison Ave., New York City 17.

Heating and Ventilating Exposition—The Tenth International Heating and Ventilating Exposition, also known as the Air Conditioning Exposition, will be held at the Commercial Museum in Philadelphia, Pa., January 22 to 26, 1951. The display will be under the auspices of the ASH&VE whose 57th annual meeting will coincide with the exposition. The exposition is under the management of the International Exposition Company, 480 Lexington Ave., New York, Charles F. Roth manager.

FEBRUARY

Industrial Waste Conference—The program for this sixth annual conference, to be held at Purdue University on February 21, 22, and 23, 1951, will cover developments in waste disposal and utilization. Reservations should be made in advance of the conference. Further information may be obtained by writing Don E. Bloodgood, chairman, Purdue Industrial Waste Conference, University, Lafayette, Indiana.

MARCH

1951 Conference and Exhibition of National Association of Corrosion Engineers will be held at the Statler Hotel, New York City, March 13, 14, 15, and 16. For the first time this organization will utilize advance registration technique in order to facilitate registration procedure at the hotel. Write 1951 General Conference Committee, P. O. Box 6120, Philadelphia 15, Pa.

APRIL

Materials Handling Exposition will feature new developments in outdoor materials handling at the International Amphitheatre, Chicago, April 30-May 4. Cranes, conveyers and similar equipment, which can be displayed but not moved indoors, will be on actual in-use demonstration. Advance registration cards and hotel information may be obtained from Clapp and Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

MAY

Third World Petroleum Congress will be held at The Hague-Scheveningen (Holland) from May 28 to June 6, 1951. For more information or copies of papers, write Office of Secretary, USA National Committee, K. G. Mackenzie, 135 East 42nd St., c/o The Texas Co., New York 17, N. Y.

REVIEWS of RECENT BOOKS . . .

The latest books, read by the Plant Engineering Group, are reviewed here for your convenience. Write directly to the publisher for those in which you are interested

Winter Roads and Walks

"Snow Melting," by T. Napier Adlam, consulting engineer on radiant heating and snow melting. Published by The Industrial Press, 148 Lafayette St., New York 12, N. Y. Illustrated. 224 pages. Price $4.50.

Here is a comprehensive treatise on the relatively new subject of snow melting systems for roads, driveways and sidewalks. Snow melting is usually accomplished by circulating hot water through pipe coils embedded beneath the road or walk surface, anti-freeze solutions being employed to prevent freezing of the fluid when snow is not falling. Another, but less popular, method is to use buried electrical cables. This book covers the design of such systems and detailed tables on amount of snowfall, air venting, pipe friction, pump selection, costs of installing and operating, and complete information on proper installation. Three chapters are devoted to descriptions and illustrations of installations already in operation.

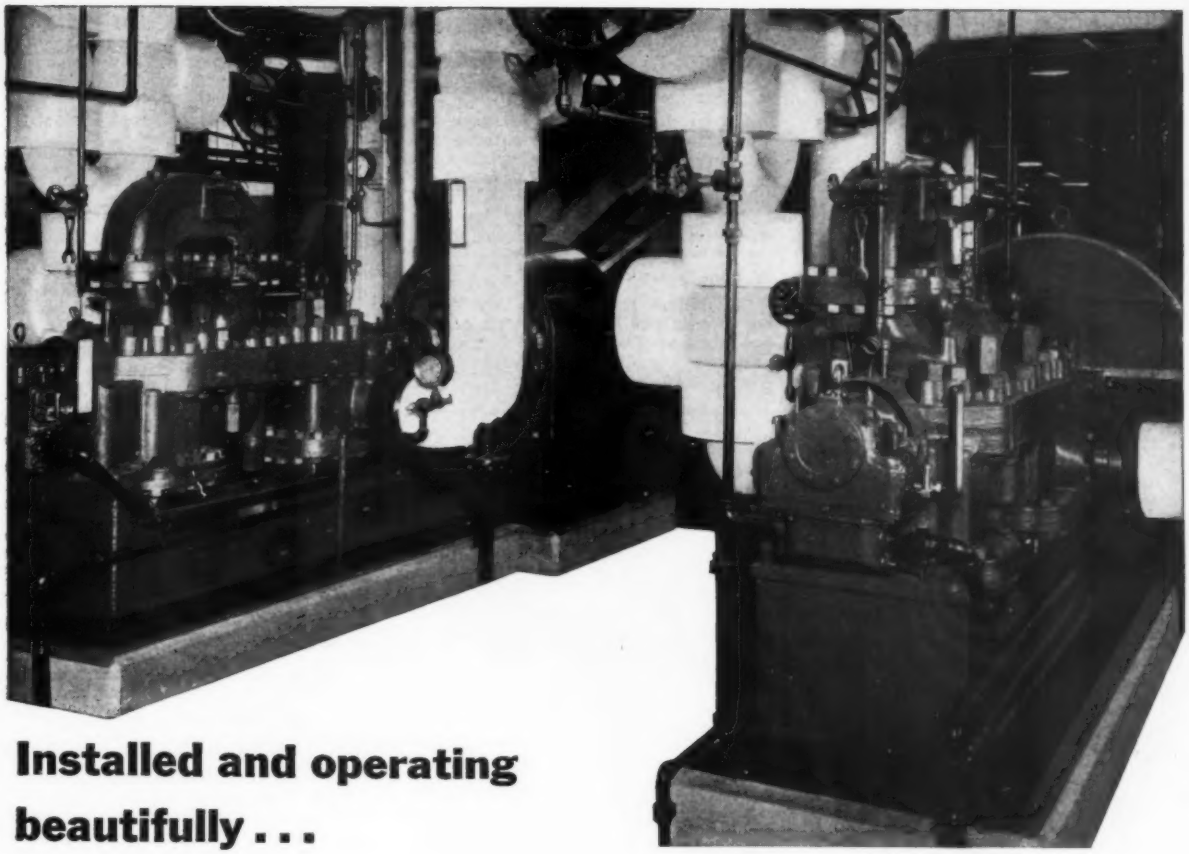
Of special importance are the 27 full page working charts covering all types of construction, which speed up the computing of pipe sizes and spacing. Also included are tables giving snow data for 270 cities.

The author has pioneered in designing, installing and testing snow melting systems. Nearly a decade ago he designed a system of piping through which hot water circulated to melt snow from the sidewalks at the Bethlehem, Pa., plant of which he is works manager. The system was so set up that test data were accumulated over a period of years. He has also acted as consultant on a considerable number of similar installations.

Examination Refresher

"Refresher Notes: Hydraulics, Thermodynamics, Machine Design for Professional Engineers License Examination," by John D. Constance. 213 pages.

(Continued on page 106)



Installed and operating beautifully . . .

TWO WARREN *Big Boys*

FOR CENTRAL MAINE POWER COMPANY

CENTRAL Maine Power Company has had many years of successful experience with Warren Pumps. Among the recent installations are two Type TH high pressure pumps at their enlarged Mason Steam Plant, Wiscasset, Maine. They are operating at capacities of 325 and 550 g.p.m. against a pressure of 900 p.s.i.g. These pumps are also available with a capacity up to 850 g.p.m. and a pressure range up to 1200 p.s.i.g. • Every construction and material feature of these Warren Pumps contribute to the highest dependability and efficiency, long life and low maintenance, with special emphasis on safety. They will prove a sound investment over the years, as numerous other Warren Pumps have in this and many other central power stations, industrial plants, municipal and Federal projects.

Write for Bulletins 241 and 244 giving complete details on Warren Pumps for higher pressure services. P-32

WARREN PUMPS

WARREN STEAM PUMP COMPANY, INC., WARREN MASSACHUSETTS

$4.50, postpaid, available from the author, 625 Hudson Terrace, Cliffside Park, N. J.

Home study and classroom text for candidates preparing for the licensing examination. Theory, text, explanations, questions with answers taken from past examinations. Complete with charts, diagrams and tables.

Valves

"Manual of Equivalent Valves," by H. Gordon Hawes, published by Hooper Publishing Co., 545 Sansome St., San Francisco 11. 175 pages. $15.00.

Of interest to specifyers, buyers and users of valves, this manual lists the valves of 18 manufacturers. All information has been checked by the valve manufacturers. It shows which valves are equivalent and the design and variations of each valve. Basically it is a guide to the differences between the valves for a given type, material and pressure rating. In case a certain valve is in short supply or unobtainable, the listing will show other valves which are equivalent. The manual also may help when quoting on an "or equal" basis.

Welding

"Procedure Handbook of Arc Welding Design and Practice," ninth edition published by The Lincoln Electric Co., Cleveland 1, Ohio. Illustrated, 1199 pages, $2.00 in U.S.A.

Here's a "JOHN CRANE" tip on a new packing value!

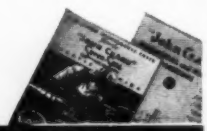
Above: Jacketed or unjacketed Super-Seal Plastic Packings in coils and spirals.
At right: Metallic and Semi-metallic spiral packing in a wide range of styles.

TODAY Metallic and Plastic Packings cost no more than Fabric styles

There never was a better time for you to switch over to more efficient metallic and plastic packings. We make fabric styles, too, but we want you to know that, at today's prices, metallic and plastic give you more for your money.

For example, graphite lubricant is vulcanized right into Super-Seal Plastic packings...which means they can't dry out like lubricated asbestos packings...and they last longer, with less gland adjustment. Metallic packings are practically frictionless on such equipment as centrifugal pumps . . . a feature resulting in longer packing life and significant power savings.

You owe it to yourself to see how this new cost picture can produce better results for you. If you are not familiar with our metallic and plastic styles, you'll want our literature. Dept. IP-11, 1831 Cuyler Ave., Chicago 13, Ill.



JOHN CRANE
PACKINGS AND MECHANICAL SEALS
CRANE PACKING COMPANY
CHICAGO
Offices in All Principal Cities in United States and Canada

First three parts consider the general aspects of welding. History, processes, equipment used, and nomenclature are broadly discussed and provide a basic introductory chapter. Weldability of metals includes uses and characteristics, reactions of the metals to welding, recommendations on electrodes and heat-treatments, and strengths and compositions for all of the common metals and alloys. Mild steel, along with such factors as preparation and type of joints, jigging and welding processes, is treated more in detail in the third chapter. Recommended currents, speeds, number of passes, deposition rates and other factors affecting cost of welding are given.

The next three parts discuss basic design of machinery and other arc-welded structures. Codes, types of joints, stress distribution, symbols and many other factors are discussed and illustrated with drawings, photographs, and charts. The desirability of designing for welded construction is stressed. Chapter on inspection and testing includes such items as methods, procedures and techniques, characteristics of metals and codes. Training, qualifications, and duties of inspectors are emphasized.

Management

"Small Plant Management," contributions by 20 authors, edited and published by the American Society of Mechanical Engineers, 29 West 39th St., New York 18, N. Y. Members' price $4.80, regular price $6.00.

This is a new ASME publication, developed to meet the need of owners and managers of small plants for techniques which can be successfully applied in their plants. Here twenty authors, each an authority in his respective field, analyze the many functions that aid in the establishment of efficient and profitable management, from the concepts and principles of scientific management to considerations in financial planning, from the legal side of production planning to sales tools and their uses, from building employee morale to machine planning.

To produce this unique guide, the ASME Management Division first determined, with the assistance of practical men familiar with small plants, what specific thinking and action would give the best operation, progress, and success in small plants and similar establishments. Outlines of topics to be covered were then prepared and qualified authors contacted to develop each.

Heat and Power Installations

Preferred Utilities' New Catalog, published by Preferred Utilities Manufacturing Corp., 1860 Broadway, New York City, N. Y. 160 pages. Price $2.50, supply limited.

Details of standard top-quality equipment used for automatic heat and power installations are included in this practical catalog and handbook. It is divided into three sections: (1) 28 pages devoted to package steam generators, oil and gas burners, ranges, water heaters, bake ovens, and other heavy equipment; (2) 98 pages of oil, gas, and other accessories, such as Draft-A-Justors, oil line accessories, and controls; and (3) 34 pages of useful data for oil and gas fired heating, hot water, and power plant installations.

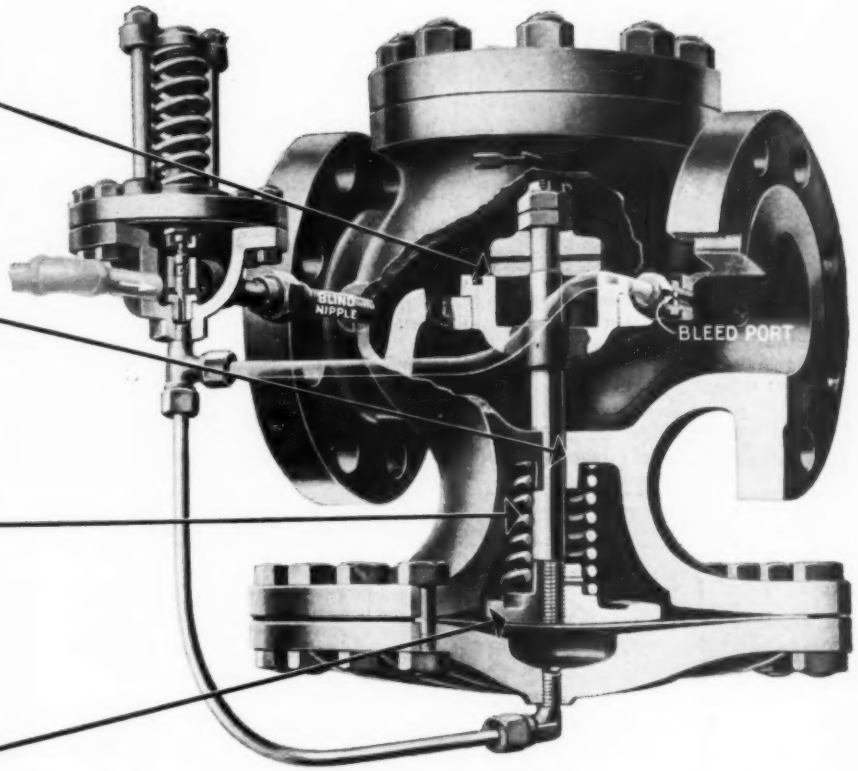
WHY Spence Regulators Outlast The Field

SECO METAL SEATS AND DISCS — Durable SECO Metal resists wiredrawing. More than twenty years of experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

PACKLESS CONSTRUCTION — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

SPRING OUT OF PATH OF STEAM — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

LARGE BALANCED DIAPHRAGM—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.



Spence Type EQ back pressure regulator — operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

DURABILITY — Spence Regulators perform dependably year after year.

ACCURACY — You can be sure of accurate control for the life of the regulator.

MAINTENANCE — You don't need expensive repairs or special maintenance. That means less down-time, less time and money wasted on replacement of parts.

SE-110

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

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High Pressure Steam
at Low Cost

SCOTTIE JR®

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6 sizes for 6 to 36 hp at 100 lbs wp . . . For coal, oil or gas . . . hand or mechanically fired.

Check the proportions of each Scottie Jr. and you'll see why it will actually produce approximately double the horse power guaranteed by its rating.

WRITE Department 96-D12
for 6" scale with pipe diameter markings

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Division of American Radiator & Standard Sanitary Corporation

RECENT INDUSTRIAL FILMS

"Selected Motion Pictures"

Association Films' 1950-51 catalog of free, rental and sale films, many of special interest to plant and factory employees, lists almost 1400 16-mm sound pictures. Foremen, supervisors, department heads, safety directors, general managers, personnel directors and industrial relations managers will find catalog helpful in arranging employee movie programs. For convenience, films are listed in such categories as: Employee Supervision, Vocational Guidance, Sports and Recreation, Transportation and Communication, Cartoons, Features and others.

Catalog may be had free of charge by writing Association Films, W. 45th St., New York 19, N. Y.

Oil Industry

A swiftly-paced panorama of oil industry operations and their relation to comforts, happiness and advancement of the American people is portrayed in the new, 28-minute, black and white film, "24 Hours of Progress," produced for the Oil Industry Information Committee by Louis de Rochemont. Ralph Bellamy of Hollywood and Broadway does the commentary on this 1950 sequel to last year's industry film, "The Last Ten Feet."

Prints may be purchased from district offices of the Oil Industry Information Committee or the national office at 50 W. 50th St., New York 20, N. Y., 16-mm for $40 each. A limited number of 35-mm prints are available at $95.

Automatic Control

Produced by the Instrument Society of America, "Principles of Automatic Control," will prove helpful in presenting the subject to executives, production supervisors and operators, technical personnel and students.

Two-part 16-mm, color-sound film has a running time of 55 minutes. It is available from the Instrument Society of America, 921 Ridge Ave., Pittsburgh 12, Pennsylvania.

Copper-Alloy Manufacture

"Quality Mill", produced by the Riverside Metal Co., takes the viewer through a modern copper-alloy mill. The movie follows production of phosphor bronze, nickel silver, cupro nickel, and beryllium copper alloys from initial casting all the way to final inspection and shipping. It is of particular interest to users, specifiers and purchasers of copper alloys; distributors and producers of metal shapes; and education and business groups.

Produced by the Princeton Film Center in cooperation with John Faulkner Arndt & Co., Inc., the film can be obtained by writing A. G. Dennison, assistant general sales manager, The Riverside Metal Co., Riverside, N. J.

GENERAL
REG. U.S. PAT. OFF.

RODA — High grade gas, by-product, steam and household stoker coal from Wise County, Virginia, on the Interstate Railroad.

DENDRON — High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA — High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX — A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

GLENBROOK — The Premium Kentucky High Splint unmatched for domestic use. Produced in Harlan County, Kentucky, on the L. & N. Railroad.

COKE — Roda and Stonega from Wise County, Va.

CRITERION COAL — High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

HAMPTON COAL — High volatile domestic, steam and by-product coal from Boone and Logan Counties, W. Va., on the Chesapeake & Ohio Ry.

CROZER — Genuine Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railway.

LYNCO — High fusion coking coal for by-product, industrial stoker and pulverizer use from Wyoming Co., W. Va., on the Virginian Ry.

ANTHRACITE
Hazle Brook—*Premium Lehigh*
Raven Run—*Premium Mahanoy*

Capable engineering personnel and the experience gained through long and varied marketing activity assure proper application of one of the above brands and effective servicing of any fuel requirement.

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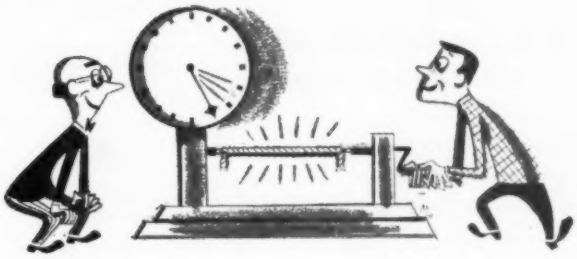
NEW YORK NORFOLK PITTSBURGH

From prehistoric times, ramie fiber has been known for its greater strength . . .

Now... Johns-Manville makes it into a packing of greater strength



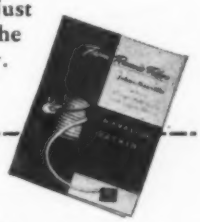
That's why *NAVALON* lasts longer than other cold-liquid packings

LONGER PACKING LIFE . . . less down time . . . lower packing costs . . . it's the same story wherever this new Johns-Manville packing made from ramie is being used in cold liquid service.

And no wonder! Navalon has the high tensile strength inherent in ramie, strongest of all the organic fibers. It has the long-lasting, rot-resisting qualities for which ramie has been known for centuries. And it is made by an exclusive Johns-Manville process which imparts unusual lubricating properties as well—another reason why Navalon consistently outperforms other high quality packings in service against fresh and salt water, brine, cold oil and many other liquids.

If you have a tough packing problem in your plant . . . need a packing that will stand up and take it when other packings let you down, we suggest you give Navalon a try.

See your distributor today. Or send for folder PK-32A that gives further details about this new money-saving ramie fiber packing. Just fill in and mail the coupon below.



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Please send me your folder on Navalon Packing (PK-32A).

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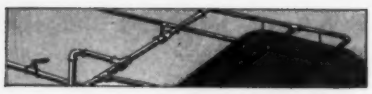
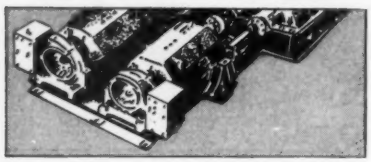


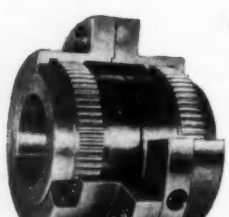
Costly Machines!



Are You Exposing Them To Serious Damage?

An extra margin of insurance against trouble is provided for users of the dependable

WALDRON
the advanced gear type
Coupling



Its exclusive construction and operating advantages recommend this modern design coupling as the best protection for your sizable investment in expensive connected machines. Our Catalog 57 explains its safety factors. Copy on request.

JOHN WALDRON
CORPORATION
NEW BRUNSWICK, N. J.
Agents in principal cities

NEWS . . . of men and companies

The Cooper-Bessemer Corp.—John Fulleman, internationally recognized authority on engine supercharging and centrifugal compressor design, has been at work with this company's engineering staff for several months, coordinating a broad engine development now under way at the Mt. Vernon, Ohio, headquarters plant. Mr. Fulleman was the field representative for Buchi, Swiss engineering firm, adapting Swiss designed exhaust driven superchargers to American engines during the war.

J. Fulleman

J. E. Stevens

Edward Valves, Inc.—The appointment of John E. Stevens, Jr., as assistant to the president has been announced. Before joining Edward Valves, Mr. Stevens was v-p of the Bergen Genspring Corp. of New York City. Previously, he had been assistant manager of engineering of the M. W. Kellogg Co. and in sales engineering with Eagle-Picher Co. and the Sarco Co., Inc.

Thomas E. Skilling has been appointed Pittsburgh district sales engineer. As representative in the area, he succeeds the Herr-Harris Co. Mr. Skilling, who has been associated with the Herr-Harris Co. for several months, will continue his office at 545 William Penn Place, Pittsburgh 19, Pa. The phone, GRant 1-6475, is unchanged.

Worthington Pump & Machinery Corp.—Austin C. Ross, manager of the Buffalo works was elected a v-p at a recent meeting of the board of directors. Mr. Ross will continue to serve as Buffalo works manager. He joined Worthington in 1932 as assistant general purchasing agent, became assistant works manager of the Buffalo works in 1935 and works manager in 1940.

Harold K. Beck has been appointed commercial v-p, in addition to his present post as manager of the Washington office. A 25-year veteran of Worthington, Mr. Beck was originally assigned to the export division in 1925 and was transferred to Washington the next year as a sales engineer. In 1933, he was appointed special representative for government contracts and, in 1934, district manager of the Washington office.

James J. Murray, owner of the Murray Equipment Co., 11820 Brush St., Detroit, has announced a distributorship agreement to handle Worthington Pump & Machinery Corp.'s Multi-V Drives and fractional horsepower belts and sheaves.

Louis G. Hilkemeier is the new chief engineer of the Construction Equipment Div. at Dunellen. Formerly a construction machinery engineer with the Chain Belt Co. of Milwaukee, Wisc., Mr. Hilkemeier has served as chairman of the Technical Committee of the Truck Mixer Manufacturers' Bureau.

Monsanto Chemical Co.— Osborne Bezanson, v-p and member of the executive committee became president and a member of the board of directors of the Chemstrand Corp., November 15. Mr. Bezanson resigned from Monsanto to accept the new position with Chemstrand, a corporation jointly owned by American Viscose Corp. and Monsanto. Mr. Bezanson's election follows the announcement last month by the Chemstrand Corp. of plans to build a multimillion dollar plant at Decatur, Ala., for the manufacture of a new synthetic fiber. Operation of a semi-production plant at Marcus Hook, Pa., where a million pounds of synthetic fiber staple will be produced annually, will also begin shortly.

H. K. Porter Co., Inc.—Purchase of the Conners Steel Co., Inc., of Birmingham, Ala., producers of electric furnace and steel products, has been announced. The Conners Co. produces steel billets from scrap by the electric furnace method and operates a series of rolling mills to manufacture finished products. The plant's total capacity exceeds 94,000 tons annually.

The Porter company has also announced the sale of its locomotive business, including patterns, drawings, and spare parts business, to Davenport-Besler Corp. (Davenport Locomotive Works), Davenport, Iowa. George Besler, chairman of the Davenport concern, explained that they will not only service all Porter locomotives now in operation, but will also build duplicate Porter locomotives, including the Porter fireless locomotives.

Owens-Illinois Glass Co.—Appointments of new plant managers for two company plants have been announced. The moves involve three men. Carl H. Smith, presently manager at the Muncie, Ind., plant of the subsidiary, American Structural Products Co., will retire December 31. His place will be taken by John E. Bauer, now manager at the Berlin, N. J., plant of the Kaylo Div. George Walker will move from the Kaylo plant at Sayreville, N. J. to become plant manager at Berlin.

Bailey Meter Co.—Five engineers have been assigned to new branch office posts. The names and new business addresses of the five engineers are: P. K. Bolyard at 184 Pryor St., S. W., At-

lanta 3, Ga.; George J. Dunegan at 424 Sharon Building, San Francisco 5, Calif.; L. F. Monahan at 1506 Kearney St., Denver 7, Colo.; R. E. Paulson at 7725 Ward Parkway, Kansas City 5, Mo.; and O. M. Thompson at 2509 Carew Tower Building, Cincinnati 2, O.

Link-Belt Co.—Bertram V. Jones has been named advertising manager to succeed Julius S. Holl, who died recently. John F. Kelly will continue as assistant advertising manager. Mr. Jones joined Link-Belt in Chiçago in 1923 and was named assistant advertising manager in 1949, becoming executive assistant in 1950.

B. V. Jones **W. A. Marsteller**

Rockwell Manufacturing Co.—William A. Marsteller has resigned, effective January first, as v-p of the Rockwell Manufacturing Co. and as v-p and director of Edward Valves, Inc. to establish The Marsteller Co., consultants in marketing and advertising. The new firm will be located at 612 N. Michigan Ave., Chicago.

American Air Filter Co., Inc.—John Hellstrom, v-p, has moved to San Francisco to become manager of the newly created Pacific Div. Under his direct supervision will be the business activities of both American Air Filter Co., Inc. and its Herman Nelson Div. of Moline, Ill., in the Pacific territory, including offices and representatives in California, Oregon, Washington, Idaho, Montana, Utah, Arizona, New Mexico, and the western part of Texas. Mr. Hellstrom's headquarters will be in the Standard Oil Building, 225 Bush St., San Francisco.

E. F. Drew & Co., Inc.—James Quigley, James Devine and Charles T. Monroe have been appointed as laboratory technicians in the Power Chemicals Div. All three are chemical engineers who have had wide experience in the boiler water treatment field. They will be in the laboratory service dept.

The Power Chemicals Div. has announced the appointment of Perry S. Lawrence as the Southwest District Manager. Mr. Lawrence has been a member of the Drew organization for a number of years as a chemical engineer acting on special assignments out of the New York City office. He will be responsible for the sale and service of Drew products in Texas, Arkansas, Oklahoma and Louisiana.

Westinghouse Electric Corp.—William H. Morse has been appointed manager of the ac mechanical engineering section in the Transportation and Generator Div. at East Pittsburgh. Mr. Morse who succeeds the late A. C. Lar-

IRON BULWARK

AGAINST CORROSIVE FLUIDS

Fairbanks® all iron gate valves

...are made of high-test alloy iron to withstand the action of many of the strongest chemicals such as concentrated sulfuric acid, alkalies, aniline oils, sodium and potassium cyanides and creosote. These iron body valves give long service under the severe operating conditions that exist with use of these destructive agents.

Fairbanks All Iron Gate Valves—like those in all Fairbanks lines—are low in maintenance cost, easy to operate and long-lasting in service... a real answer to cost-cutting needs today.

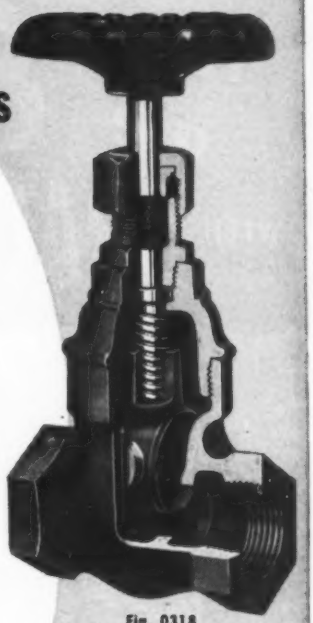


Fig. 0318
ALL IRON GATE VALVE
150# SWP 225# WOG
Non-Rising Stem • Solid Wedge • Taper Seat
½"-2" Sizes

Fig. 0904
ALL IRON GATE VALVE
125# SWP 200# WOG
Solid Wedge • Taper Seat • Malleable Iron Seat Rings
2"-12" Sizes

Fig. 0418
IRON BODY U-BOLT GATE VALVE
150# SWP 225# WOG
Bronze Mounted • All Iron Rising Stem • Solid Wedge • Taper Seat
½"-4" Sizes

For handling other types of corrosive fluids such as dry carbon dioxide, ethyl acetate, malt beverages, propane and butane gas use FAIRBANKS BRONZE SOLDER END and FAIRCO-BRAZE (silver-brazed) VALVES.

For full details consult your distributor or write direct

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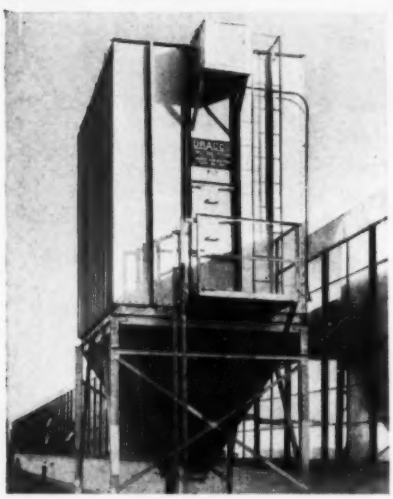
393 LAFAYETTE STREET • NEW YORK 3, N.Y.

Branches: New York 3 • Pittsburgh 22 • Boston 10 • Rome, Ga.

CASTERS • TRUCKS • VALVES • DART & PIC UNIONS

Do you have DUST?

There are 8 WAYS TO SAVE MONEY WITH DRACCO DUST CONTROL



1. Recovery of valuable materials
2. Healthier and happier workers
3. Increased efficiency of plant
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5. Eliminates occupational diseases caused by dust
6. Stops complaints by neighbors
7. Eliminates expensive law suits
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There are eight ways that DRACCO Dust Control will save you money by eliminating dust hazards in your plant. Check the list of possible savings—it is surprising how many one installation will make. Better working conditions always result from each installation of DRACCO Dust Control. This is important because it helps to draw to your plant the better and more efficient workers. The elimination of dust increases plant efficiency. If you have dust, even in small amounts, consult DRACCO Engineers for their advice. They have over 35 years' experience in dust and fume control. Why not write today and benefit by this experience?

For Further Information Write

DRACCO CORPORATION

4046 E. 116th St., Cleveland 5, Ohio New York Office: 130 W. 42nd St.

DUST CONTROL EQUIPMENT

PNEUMATIC CONVEYORS • METAL FABRICATION

son, recently developed a special synchronous-motor damper winding for starting large motors, on which he has been granted a patent.

J. M. Wallace has been named manager of the Switchgear Distribution Apparatus Department. In his new position he will be responsible for development engineering and sales activities of distribution fuses, cutouts, reclosers, capacitors, lightning arresters, and the like. Among the developments to his credit are an automatic circuit recloser, high-voltage disconnecting switches, and high-interrupting-capacity power fuses of various types. Early in 1949, he was appointed engineering manager of the switchgear distribution apparatus department, from which position, he comes to his new duties. H. H. Fahnoe, formerly in charge of engineering development on fuses, cutouts, and reclosers, succeeds Mr. Wallace as engineering manager of the department.

The Babcock & Wilcox Tube Co.—Edward A. Livingstone, v-p in charge of sales, has been named to the Steel Products Industry Advisory Committee to advise in the administration of the Defense Production Act as it affects the iron and steel industry. The committee was established by the National Production Authority.

Warren Steam Pump Co.—Edward F. Doty, designer of screw and rotary pumps, has recently become associated with this company. For many years Mr. Doty was with the Quimby Pump Co. of Newark and New Brunswick, N. J., specializing in design and application engineering. The Warren Steam Pump Co., Inc., purchased the Quimby Pump Div. of H. K. Porter Co., Inc., in August of this year.

Baldwin-Hill Co.—A new Public Utilities Div. of Industrial Sales has been created with P. A. Bell as head. Offices will be in the Reynolds Building, Jackson, Mich. M. M. Wilson continus as general manager of industrial sales, with E. R. Stevens v-p in charge of sales.

Foxboro Co.—Two new branch office addresses have been announced, one at 214 W. 10th St., Wilmington 1, Del., under the managership of Kenneth L. Barton; and the other at 225 S. 5th St., Minneapolis 2, Minn., with Robert C. Cahill as resident engineer. Foxboro interests have been represented in the Minneapolis-St. Paul area for many years but the mounting volume of business prompted the opening of a full scale branch office and the transfer of Mr. Cahill from the Appleton, Wis., branch.

Surface Combustion Corp.—An award of merit in the form of a replica of the famous "Lynn Pot", first iron casting made in America, has been presented to Donald Beggs, development engineer, by the Mines Experimental station of the University of Minnesota. The "Lynn Pot", made in 1642 first casting by the Saugus Iron Works at Lynn, Mass., has become the symbol of recognition for those who have signally contributed to the utilization of low-grade iron ore (taconite).

Aldrich Pump Co.—R. H. McPeake has been appointed sales manager of this Allentown, Pa., company. He has had eight years' oil field experience with Standard Oil of New Jersey in both the Mid-Continent and Peruvian fields. In 1938, he joined the Oil Well Supply Co., where he became export sales manager. Since the war he has been a partner in an industrial engineering and importing firm in Buenos Aires, representing American manufacturers.

R. H. McPeake

A. L. Davis

General Electric—Allan L. Davis will be manager of service of the Transportation Div. of the Apparatus Department. The position is newly-created and will be one of evaluating and analyzing service requirements for the transportation industry. Pioneer work in service practices will also be done.

Edgar A. Reiss is the new manager of manufacturing for the Wire and Cable Div. Prior to his present promotion Mr. Reiss was a manufacturing engineer in the same division.

The appointment of George Carlson as manager of G. E.'s New Kensington, Pa. Works, has been announced. In addition to his new position, Mr. Carlson will continue his present responsibility as manager of manufacturing for the Conduit Products Div. The New Kensington plant, which produces rigid and flexible conduit, is only one of the operations of the division.

R. D. Van Norstrand, designing engineer in the Schenectady Industrial Heating Engineering Div., is retiring after 37 years of service with the company. He joined the company as a student engineer in 1912.

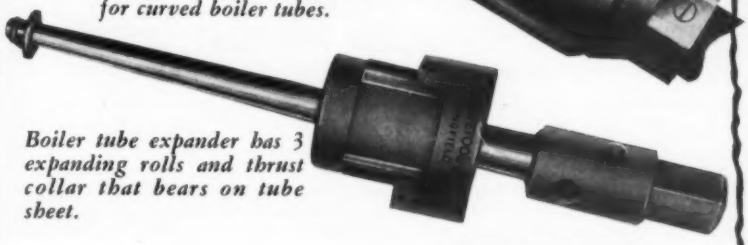
The Stultz Electric Works, 817-821 Main St., Westbrook, Maine, is the newly appointed distributor of G. E. insulating materials throughout Maine and eastern New Hampshire. In addition to maintaining complete repair facilities, the company will sell G. E. insulating materials to those industries who maintain their own repair shops.

Dr. Irving Langmuir, recently retired associate director of the G. E. Research Laboratory, was awarded the John J. Carty Gold Medal of the National Academy of Sciences, during the fall meeting of the Academy held at the Research Laboratory. The Carty medal and award were established in 1930 in honor of the late John J. Carty, a member of the Academy. It may not be awarded more often than once in two years and may be conferred on anyone, who in the judgment of the Academy, has made noteworthy contributions to the advancement of fundamental or applied science in any field. Dr. Langmuir

Airetool

designed with the O.E.* in mind

Cleaner with forwardly swing arm type cutter head for curved boiler tubes.



Boiler tube expander has 3 expanding rolls and thrust collar that bears on tube sheet.

* OPERATING ENGINEER

Operating engineers want only those products that help them do a job faster . . . easier . . . cheaper . . . better. That's why they have such an overwhelming preference for AIRETOOL tube maintenance equipment.

The boys in the boiler room depend on these AIRETOOL boiler tube cleaners because scale and foreign deposits inside tubes are removed safely and with greater speed. That's what they want!

AIRETOOL boiler tube expanders produce neatly rolled tube joints to withstand extremely high boiler temperatures and pressures. They want that, too!

Keep your own power plant in top condition! Give your operating engineer the right tools—AIRETOOL—and note the difference. Write The AIRETOOL Mfg. Co., 318 S. Center St., Springfield, Ohio, for complete information.

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MANUFACTURING COMPANY

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BRANCH OFFICES: NEW YORK, PHILADELPHIA, CHICAGO, HOUSTON, TULSA, BATON ROUGE.

There's an AIRETOOL Tube Cleaner and Tube Expander for every type of Tubular Construction.

NON-FLUID OIL

TRADE MARK REGISTERED

Stays Alive Longer

Tests prove that NON-FLUID OIL stays "alive" longer than lubricating greases when used on ball and roller bearings — providing constant, dependable lubrication.

This is due to the unique process by which NON-FLUID OIL is made, and through which it acquires greater stability and higher protective properties than can possibly be afforded by grease lubrication. Even greases which do not dry out or harden after a period of time, actually become "dead" and have little lubricating qualities.

We invite you to send for testing samples which will prove our claim that NON-FLUID OIL stays "alive" l-o-n-g-e-r, outlasting ordinary lubricants 3 to 5 times.

NEW YORK & NEW JERSEY LUBRICANT COMPANY

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NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

When You Call For Any Industrial Requirement In Piping

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***SPEEDLAY PIPE SYSTEM*—completely packaged for fast-laying temporary and semi-permanent lines for water, compressed air and other services.**

PILING—Sheet Piling—light weight • Tubular—all sizes

PILE SHELLS—Spiral Welded, Hel-Cor, Riveted, CAISSONS

PILE FITTINGS—All types and sizes for steel and wood, cast steel and iron points. Plates and shoes cast steel and malleable iron sleeves.

CULVERTS—Corrugated, Spiral or Riveted Steel.

VALVES AND FITTINGS—Tube turns, Dresser, Vitaulic, cast iron or steel, forged steel, special alloys, water main.

SPECIALISTS IN PRE-FABRICATED PIPING

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is the recipient of many awards, including the Nobel Prize in chemistry, the Faraday Medal of the British Institute of Electrical Engineers, and the Franklin Medal of the Franklin Institute in Philadelphia.

OBITUARIES

Union Metal Manufacturing Co.—Chester Andrew Orr, 67, chairman of the board, died October 10. Mr. Orr was a member of the group purchasing Union Metal in 1925 and was named v-p and general manager. A year later he became president and in 1937, chairman of the board. He served as a member of the board of governors of the National Electric Manufacturers Association and was chairman of its street lighting section for several years.

Chester Orr

B. C. Taylor

Dayton Power & Light Co.—Burt C. Taylor, v-p and treasurer, died suddenly on October 13. Mr. Taylor came to work for the Dayton company as a messenger boy in 1911 when he was just under 15 years old. In 1937 he was named treasurer, becoming v-p in 1938 and a member of the board in 1942.

General Electric—Maxwell W. Day, 85, retired head of the onetime Marine Engineering Department, died September 26. Mr. Day began his career with G. E. when the company was being formed in 1892. In 1896, largely through his efforts, the first electrically powered gun turret was installed on the battleship "Brooklyn". In 1913, working with the late W. L. R. Emmet, another G.E. turbine pioneer, Mr. Day sold the navy on the idea of installing turbine electric propulsion on the "Jupiter", introducing a succession of electrically powered ships. Mr. Day retired in 1927 after 35 years of G. E. service.

Goodyear Tire & Rubber Co.—Elmer Clark, 68, executive and member of the firm's engineering staff for the past 39 years, died suddenly October 17. He was manager of the engineering shop and maintenance, a position he had held since 1917. In addition, he was superintendent for a short period in the firm's airship building operations at what is now Goodyear Aircraft Corp.

Link-Belt Co.—Julius S. Holl, advertising manager for almost 40 years, died October 24, after a prolonged illness. Mr. Holl started out in 1905 with the subsidiary company, J. M. Dodge Co., Philadelphia. He was subsequently transferred to the parent company's Philadelphia plant and later joined the advertising department, becoming its manager in 1911.

OIL MIST

(Continued from page 86)

This separator removes 98 to 99% of moisture from the air before it enters the oil-mist lubricator.

Air pressure regulator and air pressure gage are an integral part of the system. The outstanding feature is its ability to produce an oil mist of microscopic particles that stay in suspension and can be conveyed through pipelines, without being affected to any appreciable extent.

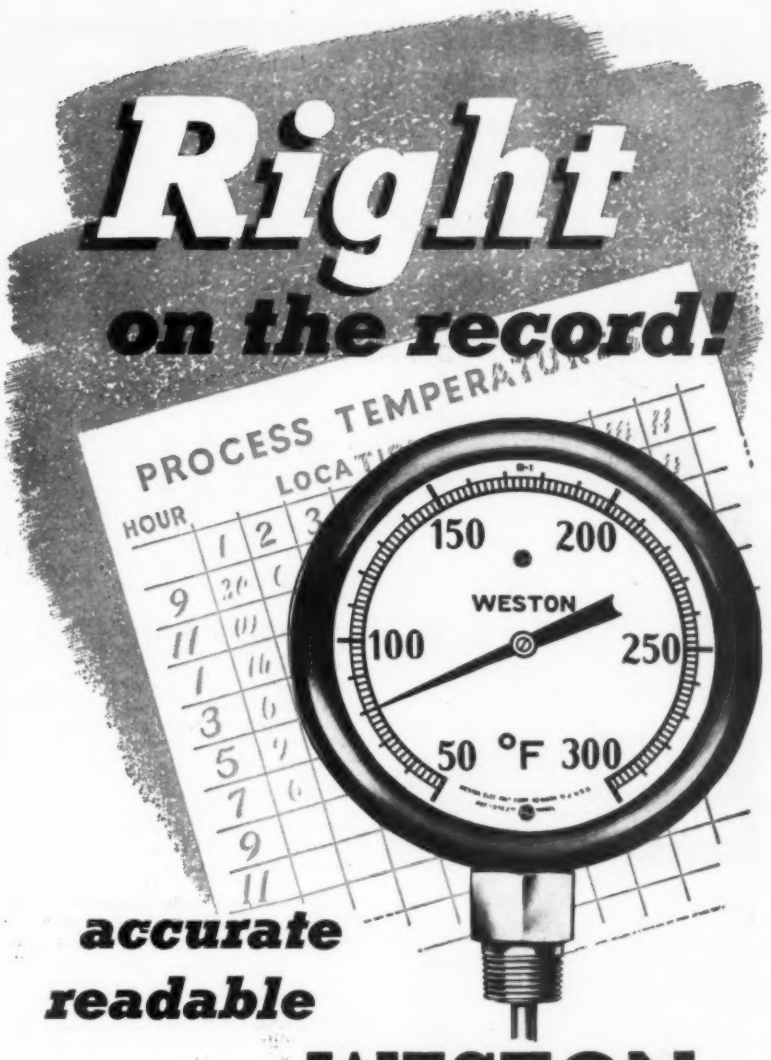
Lubricators are located usually at the base of a machine. Compressed air passes through the water separator before being connected to the lubricator through an electric solenoid operated valve, which is controlled by the machine power switch. This valve provides compressed air only when the machine is in operation, making the system both continuous and automatic. The mist is conveyed through the main lines to the top of the machine, where branch lines carry it to the bearings being served, Fig. 1.

In the housing of a drill press, Fig. 2, a maze of bearings operate under punishing, driving speed. This machine turns out a piece part every second—20 hr each day. A number of branch lines conduct the flow, which lubricates, cools and ventilates all of the bearing surfaces. The bearings pick up only the amount required for lubrication, just as an electrical motor uses only the energy it requires.

All of these bearing surfaces receive adequate lubrication. The machine operation is cooler, because fluid friction has either been removed or greatly reduced. Bearings are kept free of contamination because the oil mist pressure in the bearing area is greater than the outside atmospheric pressure.

This method of lubrication has been operating in industry since 1938. Quite a few types of installations have been made. Outstanding results have been obtained on high speed precision machines with spindle speeds of well over 100,000 rpm operating satisfactorily.

Many grinder manufacturers have found it the perfect answer to lubrication problems. For example, with its continuous lubrication application and no fluid friction, no disturbance in tolerance is permitted such as occurs under present intermittent lubrication methods. At a pressure in excess of atmospheric pressure, dust or abrasive materials do not enter the bearings. This results in much longer bearing life. In some instances, prior to its use, replacement of bearings was necessary after 300 to 400 hr of operation. Bearing life was extended with this lubrication method to as much as 7,000 hr.



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ALL-METAL THERMOMETERS

An accurate temperature record requires more than just instrument accuracy. It requires instrument readability as well. That's why WESTON Thermometers are so widely used for critical applications. A quick glance at their bold, open scales gives you the *exact* reading... no question or doubt about it. Combined with the long-time accuracy and the ruggedness for which they are famous, this feature of readability can be worth dollars to you. Why not send for complete literature today. Weston Electrical Instrument Corporation, 637 Frelinghuysen Avenue, Newark 5, New Jersey... Manufacturers of Weston and Tagliabue Instruments.

WESTON *Instruments*

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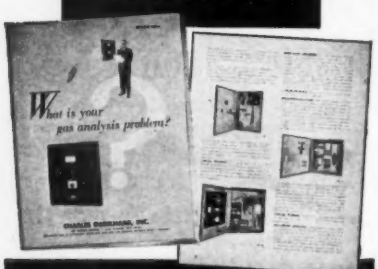
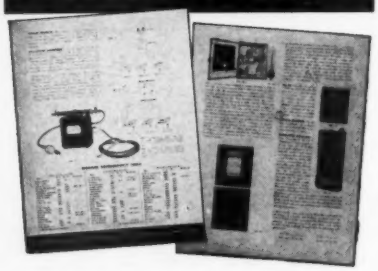
GAS ANALYSIS?

Read this New 8-page ENGELHARD BULLETIN



Look at these Data • Packed Pages



YOU WILL FIND a wealth of material on a wide range of gas analysis problems and their solutions in the new Engelhard 8-page illustrated bulletin. It explains how Engelhard equipment provides complete, sensitive, accurate analyses by the proven thermal conductivity method. The bulletin also contains a *valuable thermal conductivity table* that you will want to keep for handy reference. *Write for your free copy today. Ask for Bulletin 800A.*

Please send me FREE copy of Bulletin 800-A on Gas Analysis.

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CHARLES ENGELHARD, INC.
850 PASSAIC AVENUE, EAST NEWARK, N. J.

(Continued from page 32)

regulators? Here is a 4-page folder that gives a complete explanation of the principles of pilot-operated regulating valves in addition to data and illustrations of 27 pilots. Spence Engineering Co., Inc.

Pressure Regulators (3W). Valve for steam, air or water, which can also be used as a pump governor, is announced in 2-page bulletin. Said to be admirably suited for installations where close regulation of a pilot-operated valve is not necessary. Diagram shows how to install as a pump governor. The C. E. Squires Co.

Steam Traps (3X). Over 60 years of steam trap know-how is back of this 4-page bulletin on Super-Silvertop steam traps. Packs a wealth of information including specifications, capacities, sizes, pressures, weights and list prices of all principal types. Design and construction advantages are pointed out. Data are also contained on self-cleaning strainers and steel traps. The V. D. Anderson Co.

Thermostatic Air Vents (3Y). The whole story of purging steam systems of air is given in 4-page bulletin. Tells why heat flow is retarded as much by a 0.001 in. thick air film as by copper 19 in. thick. Describes bellows vents for pressures 0-100 and 0-200 psi. Sarco Co., Inc.

Air Operators (3Z). No packing glands or lubrication are required on these new air operators which fit DeZurik plug valves in sizes from ½ to 3 in. Easily shifted from air-to-open to air-to-close. Bulletin describes other features together with three types of control. With the bulletin you get a complete valve catalog. DeZurik Shower Co.

Materials Selection Chart (4A). You can readily pick out the most economical material for any of the 350 different corrosive conditions listed in this 4-page chart. Carbon steel along with three more expensive alloys are the materials offered. The Cooper Alloy Foundry Co.

Sprocket Rims (4B). In just a few minutes these adjustable rims are securely attached to overhead or inaccessible valve hand-wheels, eliminating the necessity of climbing on benches, ladders or boilers to operate valves. Folder describes the advantages of this low-cost chain-operated device. Babbitt Steam Specialty Co.

Corrosion Resistant Materials (4C). Valuable information and technical data on protection against the ravages of corrosion are contained in 8-page booklet on Cyclon. Industrial coatings, adhesives, process equipment linings, extrusions, chemical tubing and piping are thoroughly covered. If none of the standard products fit your needs this company is prepared to custom-compound protective materials to meet specific wants. Murray Products Inc.

Flexible Metal Hose (4D). Catalog containing the latest data should prove a valuable working tool in design and maintenance departments. Compiled so that cross references and footnotes are completely eliminated. Includes sections on interlocking high pressure hose, air-jacketed hose for diesel exhausts, conveyer hose for ventilating and exhausting, and seamless high pressure hose. Couplings applicable to the various hose comprise the last section. Atlantic Metal Hose Co., Inc.

HEATING, VENTILATING AND AIR CONDITIONING

Unit Heaters (4E). Anything and everything you wish to know about vertical or horizontal unit heaters for steam and hot water is contained in 50-page book. Crammed full of engineering and application data together with numerous photographs and drawings. American Blower Corp.

For more information use one of the convenient reply cards on page 101. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

Vibration Eliminators (4F). Put an end to the noise nuisance and the danger of broken lines in refrigeration and air conditioning installations. See how it's done with these short sections of seamless flexible bronze tubing that have standard copper tube "slip fittings" welded onto both ends. Folder gives specifications and dimensions in addition to a brief description of synthetic rubber-covered units. The American Brass Co., American Metal Hose Branch.

MISCELLANEOUS

Metal Protection (4G). Longlife is a plastic, odorless and non-inflammable product said to be one of the best materials for protecting metal surfaces. Folder tells where and how it is used and mentions its effects on metal. To anyone having the responsibility of preserving metal structures—whether metal roofs, water tanks, ducts, stacks or any other surfaces—this folder is a dependable guide. Flexrock Co.

Hi-Temp Oils (4H). The answer to your hot spot (300 to 500 F) lubrication problem will be found in this 4-page folder. It contains the results of an extensive research program. Well illustrated, it completely describes the testing procedure used in setting up three series of oils to meet all high temperature conditions. Handy chart that simplifies selection is included. E. F. Houghton & Co.

Hydraulic System Guide (4J). "Hydraulic Fundamentals and Industrial Hydraulic Oils" is the title of a completely revised 44-page technical bulletin covering fundamental information on hydraulic systems, maintenance, trouble-shooting, and selection of proper fluids. Sun Oil Co.

Lubrication Practices (4K). Folder for maintenance men and engineers, which should be in every file, covers the use and application data for 25 different Lubriko densities, ranging from liquid greases to heavy cup lubricants.

Facts on lubrication maintenance and the selection of lubricants are given. Master Lubricants Co.

Hydraulic System Maintenance (4L). Facts on oil maintenance, instructions for cleaning systems, tips on oil testing and draining are presented in an 18-page booklet. Includes trouble-shooting charts and is aimed to help foremen and operators protect vital equipment. Sun Oil Co.

Metal Cleaning (4M). The story of how this airless blasting process has influenced cleaning speeds, costs, safety, etc. and how it eliminates acid disposal in various applications is told in 4-page bulletin. Case studies show actual dollar savings. American Wheelabrator & Equipment Corp.

Anti-Corrosion Coating (4N). You'll want to study this 8-page bulletin carefully—see how well Zincilate answers your own corrosion problems. Presents case histories on well-known companies and typical applications showing its exceptional resistance to severe abrasive and corrosive conditions. Data on methods of application are included, as is an offer of providing engineering service for your particular case. Industrial Metal Protectives, Inc.

Laboratory Services (4P). Fully illustrated, new and more complete 48-page brochure describes the services, facilities and personnel of the laboratories. Government agencies and private industry may avail themselves of these services on a contract basis. Cook Research Laboratories, Div. of Cook Electric Co.

Wood Preservative (4Q). Advantages of creosote and pine content penetrating and sealing paint are pointed out in circular. Seals out moisture and kills wood-destroying bacteria, therefore prevents rot and decay. Available in black and aluminum. New price schedule and specifications are listed. Speco, Inc.

Industrial Paints (4R). Specifically aimed at users in the electrical manufacturing field, public utilities, steel fabricators and industrial maintenance, is this 16-page booklet. Contains complete information for application of primers and finishers to transformers, circuit breakers, etc. How to properly select and apply paint for industrial use is thoroughly discussed. James B. Sipe & Co.

Rust Remover (4S). Ferox is a non-inflammable solution that removes rust chemically. The manufacturer claims that it is ideally suited for most any rust remover job. In addition, it is also effective in removing rust stains from concrete and brick structures. Circular tells all about it and cites a great many applications. Service Industries.

Snow Plow Wax (4T). Circular states that the addition of silicone to this product, which also has a high carnauba content, increases daily plow mileage and gives more miles per application. Reduces friction, prevents snow from "piling up" and protects against rust. Methods of application, prices and shipping weights are listed on catalog sheet. Speco, Inc.

ROTOJET
Water-driven
TUBE CLEANERS

Deliver all the
POWER
you need for
QUICK RESULTS

ROTOJET Water-driven Tube Cleaners provide power heretofore obtainable only with air-driven equipment. A vast increase in power and a material reduction in water consumption were achieved through radical design changes based upon latest research in hydrodynamics.

The new ROTOJET removes the hardest scale much more quickly and efficiently than ever before possible with water-driven equipment. Send for new ROTOJET Bulletin.

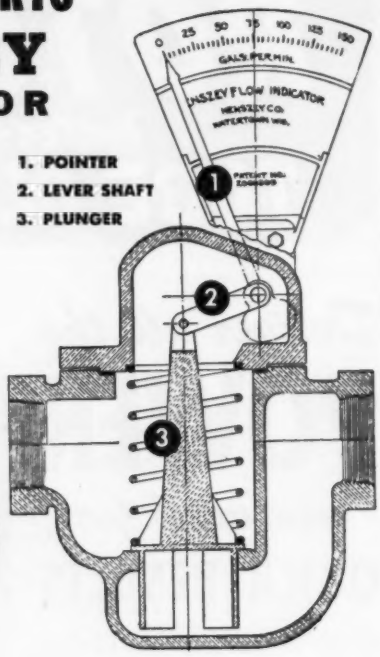
C321 ROTOJET Water-driven Motor with short 4-arm head and universal joint for 2¼" I.D straight tubes.

ELLIOTT COMPANY-ROTO DIVISION
156 Sussex Avenue Newark 1, N. J.

Only 3 MOVING PARTS *in the* HENSZEY FLOW INDICATOR

There are only three moving parts in the Henszey Flow Indicator—the Pointer, the Lever Shaft and the Plunger. And that means longer wear, continued service, and constant accuracy.

The liquid enters the indicator below the plunger, forcing the plunger upward. Slots in the side of the plunger allow the liquid to pass. Increased flow will increase the lift, exposing a greater area of the slots, so that the lift of the plunger is in direct proportion to the rate of flow of the liquid. The graduations on the dial are uniformly spaced from one end to another and read direct—without constants. The entire instrument can be installed right in the pipe line.



For details consult Sweet's Catalog or write:

HENSZEY COMPANY
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HENSZEY
FLOW INDICATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves
also MILK EVAPORATORS and PRE-HEATERS 8

On To Philadelphia . . . For NEW Ideas!

Latest developments in HEATING, VENTILATING, and AIR CONDITIONING facilities . . . latest trends and practices in adapting them to all kinds of industrial requirements . . . a wealth of practical, cost-saving ideas . . . all are in store for plant owners, managers, operators, and engineers at the—

10th AIR CONDITIONING EXPOSITION
International Heating & Ventilating Exposition

Over 300 informative, technically-staffed exhibits and demonstrations will afford you unequalled opportunity to see and compare at one time hundreds of new and improved items from complete units to maintenance supplies—to discuss your plans, problems and requirements first-hand with engineering specialists.

Plan ahead *now* to attend this foremost event of its kind . . . to get more valuable information, more progressive ideas, more worthwhile contacts than you can acquire in any comparable time or way. Note the date — January 22-26, 1951.

Auspices of the American Society of Heating and Ventilating Engineers

Management International Exposition Company

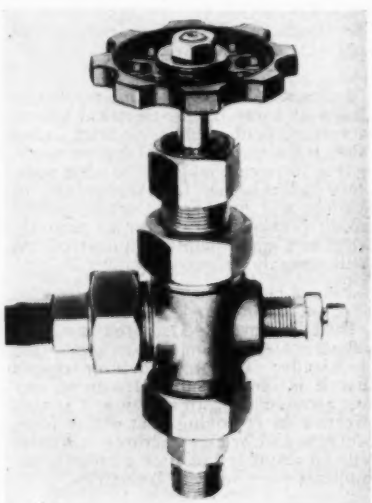
NEW EQUIPMENT AND DEVELOPMENTS

(Continued from page 18)

ger of slipping, and they do not chew up brass or other soft nuts. Made of special alloy steel, they have a lustrous chrome finish. Seven are ⅜ in. drive regular sockets with openings of 5/16 to 11/16 in., six are ⅜ in. drive extra deep sockets with ⅜ to 11/16 in. openings, and seven are ½ in. drive sockets with ⅜ to ¾ in. openings.

328—VALVES REDUCE PIPING CONNECTIONS

Valves for instrument piping and general use that reduce threaded connections from ten to three are available from Jerguson Gage & Valve Co. These complete valves are offered in nine styles with or without union outlet as well as offset and jacketed valves. One valve can be used to replace



the multiple set-up of valves and connections formerly used. Features include: safety shut-off; double-seating stem for repacking under pressure; choice of regular or quick-closing stem and lever; regrindable and renewable seats; pressure bleeder valve and test gage connection; also outside screw and yoke and throttling stem when desired.

329—GAGE CASE HAS SOLID FRONT

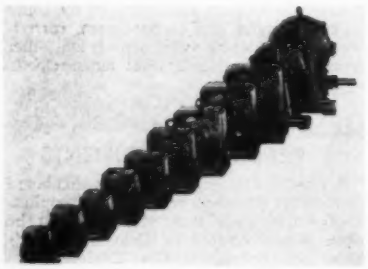
The Clapp Instrument Co. announces a solid front type of gage case incorporating a cast web backing up the dial, with the entire back of the gage case covered by a waterproof blow-out disc with bonded Buna N seal. This type of construction has two

important advantages, which are increased safety to operating personnel and greatly increased ease of maintenance. Removal of the waterproof disc exposes the entire mechanism for inspection, repair, or recalibration without removing the dial. Available in a full range of sizes from 4½ through 10 in. in both surface and flush mounting design with all types of bourdon tubes, for ranges from 30 in. vacuum to 80,000 psi. Standard movements are either of stainless steel, or nylon and stainless steel.

For more information use one of the convenient reply cards on page 101. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

330—SPEED REDUCER HAS 0.45 TO 588.23 RPM RANGE

Boston Gear Works has announced the addition of improved, heavy duty model Reductors to their already extensive stock line of speed reducers. An improved numbering system makes it easy to select the correct unit for any speed reduction requirement. There are eight types, each in a range of speed ratios and horsepowers or load carrying capacities. Gear ratios run from 1 to 1 up



Buy the Bonus Union DART

This True Ball Joint Makes the Difference

BONUS NO. 1

Because of the precision-machined, true ball joint, a Dart can be made leakproof without excessive wrenching. Installation is fast — no need to jam a Dart to get a tight joint.

BONUS NO. 2

A Dart stays tight — bronze-to-bronze seats give longer wear — have higher resistance to pitting and corrosion. And body and nut of high test, air-refined, malleable iron are practically indestructible — shrug off wrench abuse and punishment in use.

BONUS NO. 3

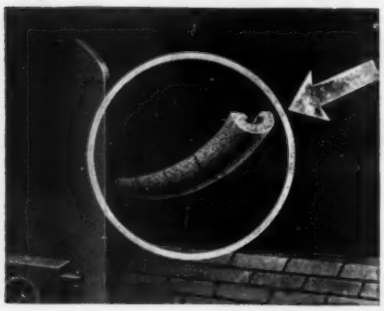
Because they never require jamming, the seats in a Dart union retain their true bearing surface — stay unmarred. Thus you can reinstall a Dart again and again — yet be sure of a tight joint.

For dividends in longer service, faster installation, always specify Darts.

E. M. DART MFG. CO.
Providence 5, Rhode Island

DART UNIONS

What if the seam let go?



After the lapped edge at the circumferential seam of an HRT boiler has burned off close to the rivets, there is danger of the seam opening up under pressure. The consequences might be serious.

National Seam Protectors prevent fire-cracking and oxidation of boiler plates at seams. Owners of riveted HRT boilers have found National seam protection practical and profitable during the past 34 years.

You should get all the facts. Write us now while you're thinking of it.

NATIONAL BOILER PROTECTOR CO.
928-9 Rybold Bldg., Dayton 2, Ohio

ARMSTRONG BROS.
***Better* PIPE TOOLS**

PIPE CUTTERS

"ARMSTRONG BROS." Three Wheel and Standard wheel and roller Pipe Cutters are quality cutters throughout . . . built to give years of good service.

"ARMSTRONG BROS." drop forged Pipe Cutters are built for lifetime service with 1-piece drop forged steel heat treated body and a replaceable hardened steel nut to take up the wear and thrust of handle screw. Used either as 1-wheel (with 2 rollers) or 3-wheel (for close quarters).

"ARMSTRONG BROS." Knife Blade Cutter Wheels are machined from special alloy tool steel properly heat treated. They cut rapidly and easily, hold their keen edge.

Write for Catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5237 W. ARMSTRONG AVENUE • CHICAGO 30, ILL.

to 4000 to 1. Output speeds, based on full load motor speeds, run from 0.45 to 588.23 rpm for the full line.

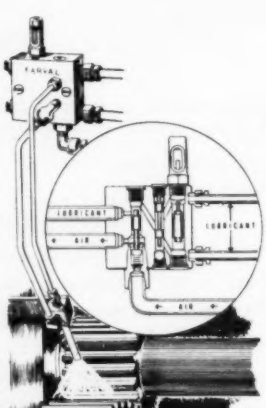
340—AIR FILTER GIVES LINE PROTECTION

A. Schrader's Son Div. announces an air line filter, which features a filtering element composed of hundreds of laminations of a fine, newly developed material. The filtering

area is large enough to assure full air flow even after long periods of use. Moisture that is trapped can be removed through a handy drain cock. Available in three standard pipe sizes—¼, ⅜ and ½ in. Pipe connections are the straight in-line type. When placed in the airline ahead of any air control mechanism or air operated tools, it protects them by removing rust, dirt and moisture from the line.

341—GREASING SPRAY VALVES AIR OPERATED

The Farval Corp. has announced the development of a spray valve. With this device, either grease or oil can be sprayed onto



open gearing, slide surfaces, or any other area where it is desirable to apply a measured amount of lubricant at regular intervals. It can be operated wherever compressed air is available—either as an addition to a regular lubrication system or in a complete system of spray valves, served by either a manual or automatic pump unit.

342—LABORATORY METER HAS HIGH SENSITIVITY

Instrument for research and routine work has been developed by Central Scientific Co. in collaboration with Dr. Theodore E. Friedemann and George S. Liebeck that has linear sensitivity over a wide range. The relative sensitivity is changed by means of

a dial switch, which expands the meter readings to 1, 2, 5, 10, 20, 50 and 100. It also has a high sensitivity to permit the assay of microquantities even though highly selective optical filters may be used. Cuvette carrier is designed to hold a standard 15 mm test tube and primary and secondary 2 x 2 in. optical filters. Unit operates from commercial a-c power through a 250-w constant voltage transformer.

For more information use one of the convenient reply cards on page 101. No postage necessary. Insert the key numbers of items about which you want additional information mailed to you.

343—BOILER LIQUID LEVEL INSTRUMENT ANNOUNCED

The Foxboro Co. has announced the development of a boiler feedwater and boiler drum level control system utilizing the new 25 in. d/p cell differential pressure transmitter for measurement of liquid level. This system has been successfully used in order to maintain accurate ratio between the input boiler feedwater and output steam, correcting the ratio during swell periods and other irregularities, by liquid level measurement.

344—LONG RANGE READING INSTRUMENTS

A line of 8¾ in., long-scale switchboard instruments designed primarily for applications where long-range readings must be taken is now offered by General Electric's Meter and Instrument Div. Designated as

Types AB-16 (a-c) and DB-16 (d-c), the instruments employ 250-degree scales 14.2 in. long for legibility. Suitable for use on swinging brackets or other installations remote from the control station, the instruments are housed in dustproof, moisture-resistant cases, designed for semi-flush mounting, and constructed of a steel shell, with a textolite base and diecast cover. Instruments are equipped with shock-resistant bearings, which provide protection for jewels and pivots under all normal and many adverse conditions. Jewels are spring-mounted to protect the pivot point from shock.

345—COMPACT DESIGN SOLENOID VALVE

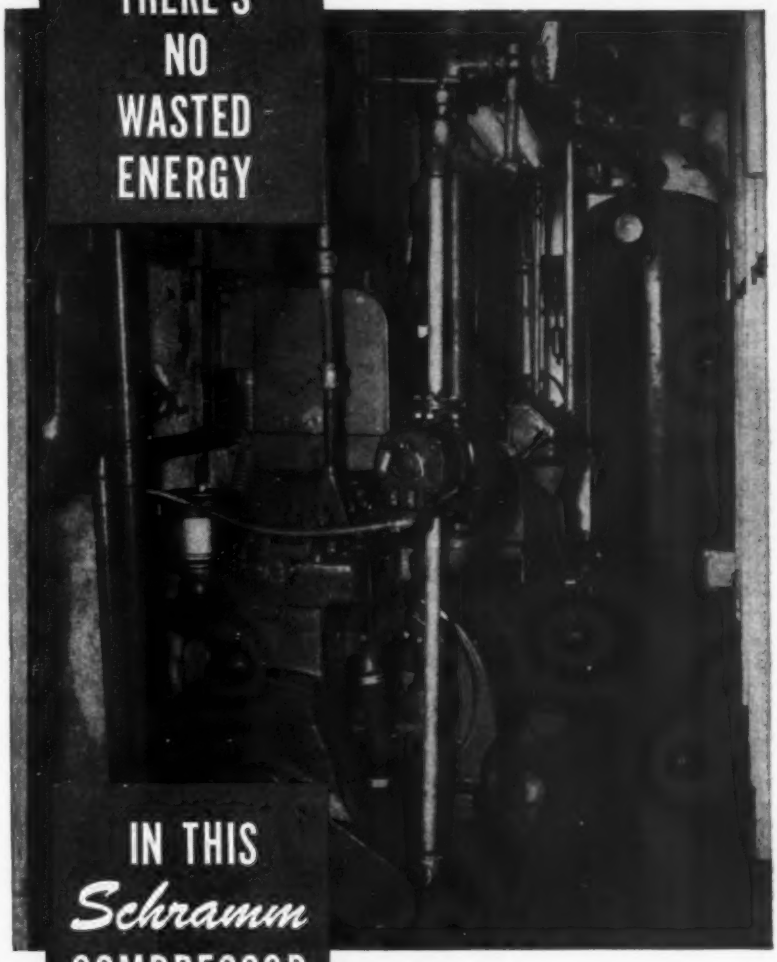
Automatic Switch Co. announces two important additions to its line of ASCO two-way and three-way packless solenoid valves. These compact solenoid valves are designed to take care of very severe and frequent service. All proved values have been in-

corporated in these valves, which are designed to handle a wide range of liquids and gases at temperatures up to 212 F. They are particularly suited for assembly in equipment where a compact, efficient and durable automatic control is needed such as with oil burners, dispensers, measuring and testing apparatus, gas heaters, power cylinders and diaphragm motor controls.

346—THREAD RESTORER WORKS IN CLOSE QUARTERS

Thread restorer suited especially for reconditioning closely spaced studs and bolts that are battered, distorted or rusted, is being produced by Buckingham Mfg. Co., Inc. This latest product completes a range of sizes

THERE'S NO WASTED ENERGY



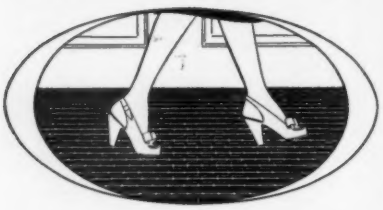
IN THIS *Schramm* COMPRESSOR INSTALLATION! . . . providing worthwhile *profits!*

Three of ten SCHRAMM Air Compressors installed in the various shops of Boyertown Auto Body Works, Boyertown, Pa., not only provides air for operating pneumatic tools and appliances, but goes even futher—and delivers BTU's into a system suitable for space or process heating; providing warmth and comfort in winter and air conditioning in summer! By taking full advantage of the uses to which Schramm Air Compressors may be put, naturally, profits result.

For the interesting facts on the conveying of energy, write today for Bulletin P-10.

SCHRAMM INC.
The Compressor People
WEST CHESTER • PENNSYLVANIA

THE SAFE OPEN STEEL FLOORING IS TRI-LOK



No object over ½ square inch can pass through super-safe U-Type Tri-Lok Flooring. It is unsurpassed for plant installation, walkways, loading platforms. Maximum strength, air and light with minimum weight. Efficient distribution of concentrated loads. Write for Bulletin KA 114

The Tri-Lok Company is also equipped to furnish *riveted* and Tri-Forge *welded* open steel flooring. Tri-Lok can be furnished in a variety of metals, including aluminum alloy, stainless steel, etc.

DRAVO CORPORATION

National Distributor for the
Tri-Lok Company
Dravo Bldg., Pittsburgh 22, Pa.
Sales Representatives in
Principal Cities

DRAVO

BETTER WATER

IS AN ASSET TO THE ENTIRE COMMUNITY

Manufacturing, processing, heating and cooling always improves with pure, bright water. If your water supply needs treatment to remove hardness, iron, taste or odor it will certainly pay to have your problem surveyed by GENERAL FILTER CO. engineers.

G.F.C. is part of the LAYNE organization with engineering and construction facilities in every area. A complete service is offered, from the first survey to the installation of economical and efficient water purification equipment.

Write For Detailed Information Today

A Layne Affiliate
GENERAL FILTER CO.
923 2nd St. • Ames, Iowa

that accommodate ASME and SAE standard threads from ¼ to 4 in. dia. This thread restorer works readily in close quarters. Adjustable cutting jaws can be fitted by a simple twist of the handle to any male thread of ¼ to 1 in. root dia—either right- or left-hand. The jaws may be engaged at the bottom of the threaded section and turned out toward the top, leaving clean end threads. Compactness of the unit makes it handy for carrying in tool kits. No die sets are required for interchange for size or type of thread. The tool is completely self-contained, and weighs only 1¼lb.

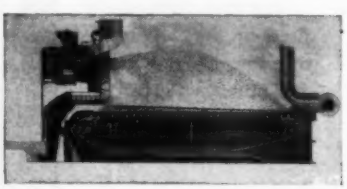
347—HAND OPERATED TOOL REMOVES WIRE INSULATION

Ideal Industries, Inc. announces the purchase of Pyramid Products Co. who manufactured a small, hand-operated tool for quickly removing insulation from wire. This

tool, which works like a pair of pliers, is of all steel construction. Simple operation and dependability have made it a favorite of electricians and production men for years.

348—TRAVELING GRATE HAS HYDRAULIC SPREADER

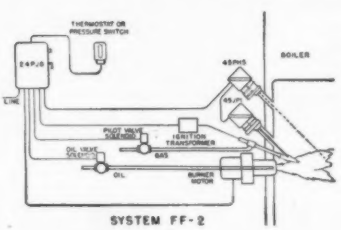
Spreader type stoker with traveling grate designed to meet the requirements of medium to large industrial plants and central stations is available from Westinghouse Electric Corp. These stokers, having fuel-burning capacities from 30,000 to over 350,000 lb of steam per hr, are built in sizes suitable for all standard boilers within this range. Coal is spread by a hydraulic motor-driven overthrow rotor so that it falls evenly over the entire length of the fuel bed. The forward-moving traveling grate discharges ashes continuously at the front. Coal is fed to each rotor by two long-stroke, constant velocity rams. A coal-feed equalizer plate driven from the rotor oscillates across the incoming fuel assuring continuous uniform feed whether the coal is wet or dry. Complete integrated hydraulic drive system for fuel feed, fuel distribution, and grate drive provides a synchronized drive with independent control and adjustment for each element.



349—FLAME SAFEGUARDS FOR GAS-OIL BURNERS

To meet the need for reliable, positive-acting flame failure safeguards and controls on gas-oil conversion burners, Combustion Control Corp. offers a system for supervising both the pilot gas flame and the main flame on industrial gas-oil burner installations. A flame rod "feels" the gas pilot flame and if the pilot does not ignite, signals this condition to the programming control, shutting down the burner. With proper pilot ignition the main fuel valve opens. Its flame

FULL-AUTOMATIC FLAME CONTROL, GAS PILOT AND OIL BURNER

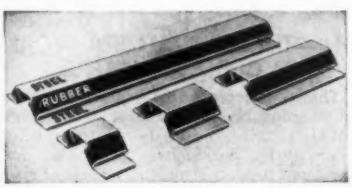


SYSTEM FF-2

is then monitored by the scanner when oil is used, or by the flame rod when gas is the main fuel. Programming control is designed to provide accurate settings of both fuel valve delay and post ignition periods. A large dial, calibrated in seconds, simplifies both settings. Timing is accomplished through a synchronous motor.

350—ISOLATOR COMES IN FOUR STIFFNESSES

Finnflex type 9 vibration isolator manufactured by Finn & Co., is easily adaptable to practically all types of machinery and equipment. It consists of a specially designed steel channel floated in rubber between two steel angles. The correct angularity between the steel parts and the rubber securely bonded thereto enables the isolator to approximate the flat spot on a stress - strain curve of relative slope. Because the spring index is not constant, resonance is avoided. Available in any length up to 18 in., in four rubber stiffnesses for loads of 40, 50, 70 and 105 lb per in. of length at ¼ in. deflection.



"SPOT" NEWS OF INDUSTRY

(Continued from page 89)

single setting of the Ductulator, which has four colors on four scales.

Knowing the air volume and velocity the engineer can find friction loss per 100 ft of duct, the diameter of the round duct and dimensions of the rectangular duct that will carry the air load, all with one setting of the slide rule.

The Ductulator is available for one dollar (check or money order) from the Trane Co., Educational Div., La Crosse, Wisc.

AEC Releases More Non-Secret Patents and Patent Applications for Public Use

A number of patents and patent applications owned by the U. S. government and held by the Atomic Energy Commission have been transmitted to the U. S. Patent Office for registry and listing in the Official Register of Patents. The Commission will grant non-exclusive, royalty-free licenses on the listed patents and applications, as part of its program to make non-secret technological information available for use by industry. A total of 185 Commission-held patents and patent applications has now been released for licensing. Applicants for the licenses should apply to the Chief, Patent Branch, Office of the General Council, U. S. Atomic Energy Commission, Washington 25, D. C., identifying the subject matter by patent number and title. Copies of these patents may be obtained from the Patent Office.

Patent No. 2,525,197, *Thermal Flowmeters,* issued October 10, 1950, to J. W. Beams, L. B. Snoddy, and L. G. Hox-

ILLINOIS

Thermostatic Traps

for Medium and High Pressures

Series HG

Maximum Working Pressure 150 pounds gauge

For trapping instrument sterilizers, water stills, coffee urns, warming tables and similar equipment.

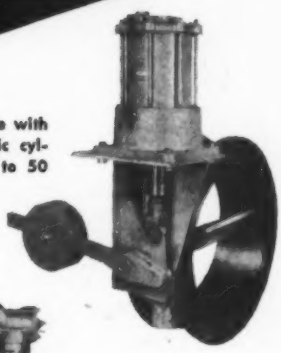
Where appearance, compactness and smaller capacities of the trap must be considered, it is sometimes preferable to use a high pressure thermostatic trap, as illustrated, instead of a float type.

WRITE FOR LITERATURE

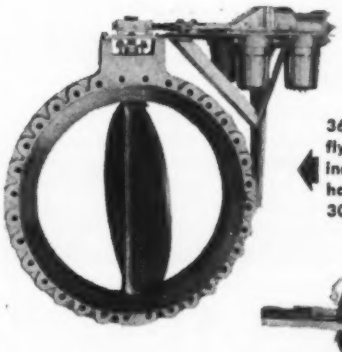
ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST. STREET • CHICAGO 8

ROCKWELL VALVES

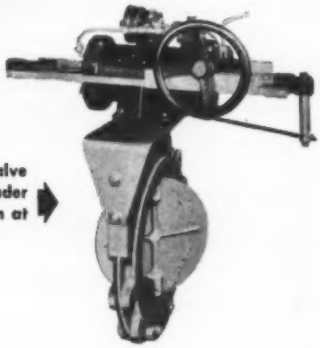
with **Hydraulic Control** for Shut-Off and Throttling of Air—Gases—Steam—Liquids and Semi-Solids



24" cast steel butterfly valve with Hanna oil-operated hydraulic cylinder for handling gas up to 50 p.s.i. at 250° F.



36" semi-steel wafer butterfly valve with hydraulic cylinder and limit switches for handling air at 25 p.s.i. and 300° F.

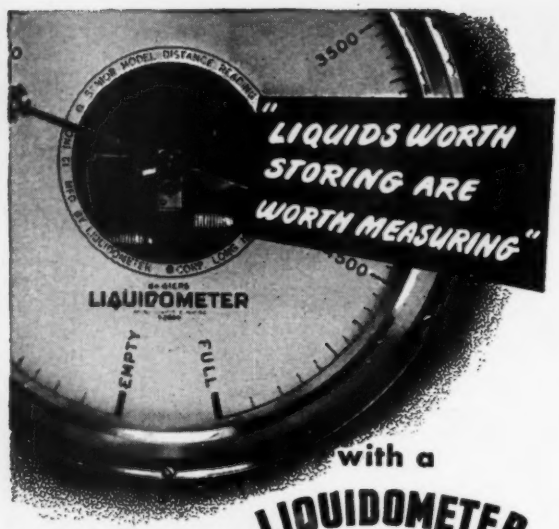


12" wafer type butterfly valve with Hagan hydraulic cylinder regulator for handling steam at 5 p.s.i. and 240° F.

30" stainless steel butterfly valve equipped with Republic Flow Meters Co. hydraulic cylinder, pilot valves, pneumatic positioner, Selsyn meter units and declutchable hand wheel; for handling saturated air at 5 to 65 p.s.i.

These are but a few examples. Rockwell Valves are made in butterfly and slide types—with any type of manual or automatic control—in pipe sizes from 1" to 84"—for normal or heavy duty pressure or temperature. Write for Catalog.

W. S. ROCKWELL COMPANY
230 Eliot St., Fairfield, Conn.



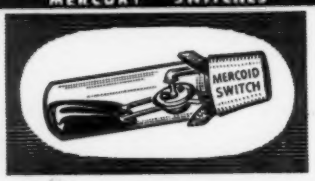
with a **LIQUIDOMETER** *Tank Gauge*

- FOR GAUGING LIQUIDS OF ALL KINDS
- 100% AUTOMATIC
- APPROVED BY UNDERWRITERS' LABORATORIES

WRITE FOR COMPLETE DETAILS

THE LIQUIDOMETER CORP.
36-32 SKILLMAN AVE., LONG ISLAND CITY, N.Y.

MERCOID
MERCURY SWITCHES



Superior Quality and Workmanship

They are not affected by dust, dirt or corrosion and have many definite applications where open contacts are not suitable. Various types available. MERCOID is your guarantee of the best in mercury switches. Further information sent upon request.

MERCOID
SOLVES INDUSTRY'S AUTOMATIC CONTROL PROBLEMS

catalog upon request.

THE ONLY 100% MERCURY SWITCH EQUIPPED CONTROLS

Designed to automatically regulate electrically operated equipment in accordance with changes in temperature, pressure, vacuum, or fluid level.

If you have a problem on the automatic control of pressure, temperature, liquid level, mechanical operations, etc., it will pay you to consult Mercoid's engineering staff — always at your service.

THE MERCOID CORPORATION
4327 West Belmont Avenue, Chicago 41, Illinois

MANUFACTURERS OF AUTOMATIC CONTROLS FOR HEATING, AIR CONDITIONING, REFRIGERATION AND NUMEROUS INDUSTRIAL APPLICATIONS. ALSO MERCOID BRAND MERCURY SWITCHES.

ton. This thermal flowmeter will measure accurately the mass rate of flow of gases at low pressures and flow rates.

Patent No. 2,528,415, *Pump,* issued October 31, 1950, to H. A. Boorse and Gilbert F. Boeker. An electromagnetic pump particularly adapted for pumping corrosive, poisonous or noxious fluids is characterized by an electromagnetic device exterior to the cylinder, capable of simultaneously rotating and reciprocating a piston within the cylinder.

Patent No. 2,528,436, *Stuffing Box and Expansion Joint,* issued October 31, 1950, to M. E. Johnson. This patent discloses a stuffing box and expansion joint assembly for a retort containing a rotating shaft arranged so as to permit longitudinal expansion and misalignment of the retort without interfering with the rotation of the shaft or disturbing the gas-tightness of the stuffing box.

Latest Steam Unit at Oswego Will Add 80,000 Kw for Central New York Use

Installation has begun on the fourth steam generating unit for the Oswego, N. Y., steam station of the Niagara Mohawk Power Corp., according to officials of The Babcock & Wilcox Co. who built the equipment. This addition is part of one of the largest power developments under construction in the country at the present time.

The Oswego station furnishes power for Syracuse and central New York state. According to B&W engineers, when the present unit goes into operation, it will add 80,000 kw at manufacturers' rating but is capable of delivering 100,000 kw to the plant's present output of 240,000 kw.

The Oswego station was opened in 1940 with one B&W Radiant boiler. In 1941 and 1948 two more boilers were added, each, like the first, serving an 80,000 kw turbine

New *VERSENE test kit determines total water hardness in less than *TWO MINUTES***

Now, with this new Versene* water hardness testing kit you can determine the hardness of your own boiler, process or tap water as easy as ABC—in less than 2 minutes. Anyone who can tell red from blue can make this scientific versenate test and be accurate within one grain of hardness per gallon.

Handy, sturdy, pocket-size plastic kit contains 3 vials of chemicals and one combination measuring and mixing vial. More than 50 separate tests can be made, depending on water hardness. Complete instructions. Refills available.

Order The New Versene* Water Hardness Testing Kit today. $5.00 Postpaid. Send Checks or M.O. No C.O.D.'s. Money Back Guarantee.

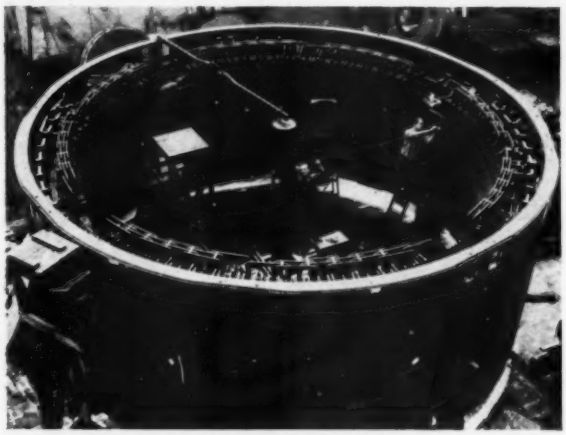
We also manufacture and supply Inhibited Indicator and Di Sodium Versenate (the di sodium salt of ethylene diamine tetra-acetic acid). These are the reagents used in the Versenate (Schwartzenbach) Method for the determination of Water Hardness.

Di Sodium Versenate
50 g. $2.00 100 g. $3.00 500 g. $10.00
Inhibited Indicator
100 cc $1.00 250 cc $2.00 500 cc $3.00 1000 cc $5.00

BERSWORTH CHEMICAL COMPANY
FRAMINGHAM, MASSACHUSETTS

*Trade Mark

generator. The latest boiler, which is expected to go into operation early in 1951, will also serve an 80,000 kw turbine generator. The boiler will have a maximum continuous capacity of 655,700 lb of steam per hr, with a designed pressure of 1675 psi and operating pressure of 1492 psi at 1000 F at the superheater outlet. It will be equipped with a reheater producing 574,000 lb of steam per hr at a reheat pres-



NEW GENERATOR FOR SEATTLE

66,700-kva hydro generator being constructed by Westinghouse Corp. for the Gorge power house on the Skagit River. The generator weighs 580 tons, stands 21 ft high and measures more than 36 ft in diameter. The rotor weighs 287 tons and rotates at 164 rpm. Workmen are using a pin guage to check stator for roundness before mounting end bracket

Utility Triples Life of Its Boiler Burner Blocks

by using

R&I SUPER-MOLDIT

Moldit is made in several types for various boiler refractory parts. It lasts longer—it saves in overall costs.

Replacing burner blocks every 6 months was neither efficient nor economical, even though they were subjected to very high temperatures and oil erosion. The engineers wanted a refractory that could stand the gaff longer, and finally found the answer in R & I Super Moldit.

Using metal molds, the blocks are cast in quarter sections with R & I Super Moldit Refractory Cement. These sections form an externally rectangular shaped block which simplifies installation because it eliminates fitting the brick wall around the usual cone-shaped blocks.

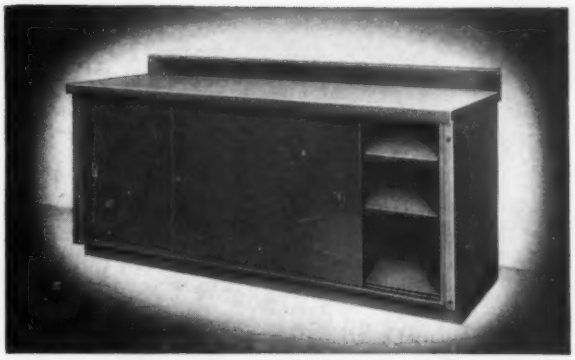
Where other blocks melt, spall, crack and wear away, Super Moldit blocks stand up three times as long and cut replacement costs in half.

It will pay you to investigate R & I Super Moldit for your special refractory castables. Write for bulletin.

REFRACTORY & INSULATION CORP.

119 Wall Street New York 5, N. Y.

Chicago 4, Ill. Newark 2, N. J. Philadelphia 7, Pa. Cleveland 15, Ohio



ARISTOCRAT of WORK BENCHES

. . . built for men accustomed to the finest tools and equipment

We "pulled out all the stops" when we designed the HALLOWELL Cabinet Bench, giving it more "custom" features than any other stock bench we know of. All-steel construction, choice of top materials, ample storage space, standardized units, interchangeable accessories, and trim good looks are just a few of its advantages.

Bulletin 702 tells the story. Write for your copy today!

HALLOWELL

SHOP EQUIPMENT OF STEEL

SPS STANDARD PRESSED STEEL CO.

JENKINTOWN 39, PENNSYLVANIA

DeZURIK Has The AIRTIGHT ANSWER To Your VALVE PROBLEM

DeZURIK VALVES are famed for Air-tight, drip-free closures on any flow, and the complete DeZurik line has the perfect answer for every valving requirement. Models for manual or remote control . . . 1-way to 5-way . . . ½" thru 20" . . . in all metals.

Write for catalog.

DeZURIK SHOWER CO.

SARTELL, MINN.

Whether you want standard drives or special units, Cleveland can serve you.

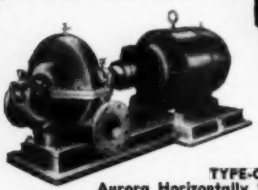
Prompt service on dependable worm gearing

CLEVELAND offers a complete line of worm-gear sets and speed reducers, including the popular fan-cooled Speed-aire, to meet the needs of any machinery or equipment builder or user. Representatives in all major industrial centers are at your service. Write for the latest Cleveland catalog, indicating your requirements. Your inquiry will receive prompt attention. The Cleveland Worm & Gear Company, 3253 East 80th Street, Cleveland 4, Ohio.

CLEVELAND
Worm Gear
Drives

Member of a Great Pump Family

There is a PUMP *by Aurora* for every pump job.



TYPE-OD
Aurora Horizontally Split-Case, Double Suction, Single Stage Centrifugal Pump.

For general water supply for municipalities, industries, office buildings, institutions—also—for handling liquids, chemical solutions, oils etc., in a wide variety of industries. Write for Bulletin 105-M for further details.

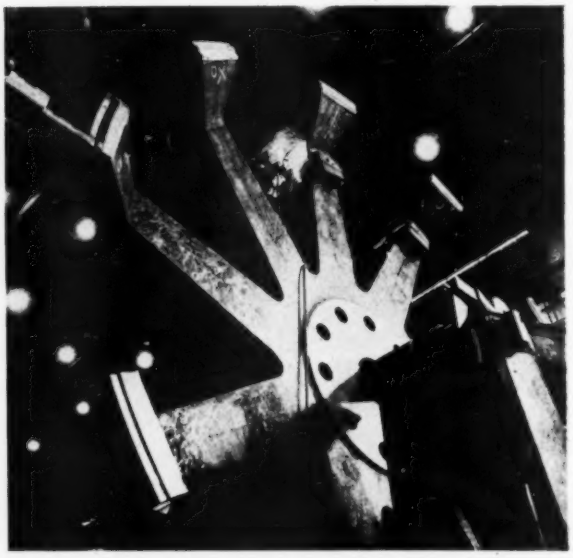
DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS

AURORA PUMP COMPANY

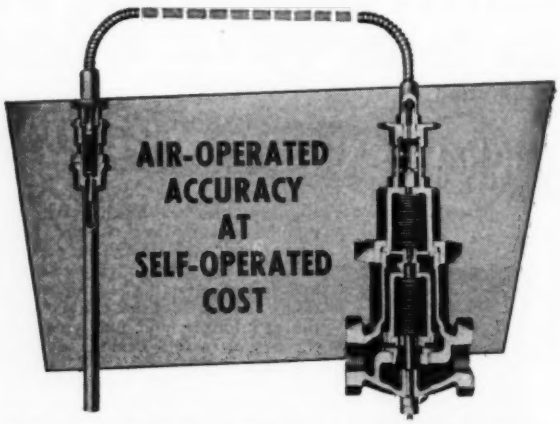
42 Loucks Street, Aurora, Illinois

sure of 405 psi at a reheat temperature of 1,000 F. This unit will bring the total steam capacity of the B&W one-boiler-per-turbine installation to 3,330,700 lb of steam per hr.



INNER FRAMEWORK FOR COULEE GENERATOR

This giant 70-ton spider is the inner framework for one of the 108,000-kva waterwheel generators for Grand Coulee Dam. Having a diameter of 31 ft, completed rotor will weigh 542 tons and will rotate at 120 rpm. At this speed a point on outer edge will be traveling more than 132 miles per hour



Self-operated Farris **Stacon Temperature Regulators*** make possible unheard-of control accuracy—**to within plus or minus 1 deg.** How? Because liquid in the bulb flashes to vapor in power bellows. Steam does 99 per cent of the work . . . instantly. Balancing bellows eliminates spring counterpoise and packing glands . . . prevents response to variations in steam temperatures . . . provides free-floating valve disc.

Compact, trouble-free, dirt-proof, hermetically sealed Stacon Regulators operate consistently in the worst possible surroundings—require no maintenance. To learn more about the most sensitive, accurate, economical temperature regulator available, write for Stacon Bulletin 50-1000.

*Patented

6690

Farris Stacon Corp.

433 COMMERCIAL AVE. PALISADES PARK, N. J.

Great Lakes Air Pollution Program Comes Before International Commission

The Great Lakes air pollution abatement program was brought before the International Joint Commission, a six-man board of United States and Canadian members concerned with pollution problems affecting the Great Lakes, at a joint meeting of the two groups in October.

The International Commission was sufficiently impressed by the scope of the study being made that it expressed a desire to see a closer relationship established. The Commission took under advisement the matter of emission standards. H. B. Lammers, chairman of the Coal Producers Committee for Smoke Abatement, suggested that either the Milwaukee code or one closely resembling it be adopted by the International Commission.

The Great Lakes air pollution abatement program is sponsored by the Lake Carriers Association and Bituminous Coal Research, Inc., with the Coal Producers Committee for Smoke Abatement acting in an advisory capacity and also supervising the observations being made on the numerous lake vessels.

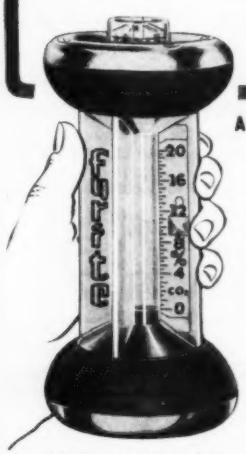
Inhibited Insulating Oil Now Standard in Westinghouse Distribution Transformers

Inhibited insulating oil is now standard in all Westinghouse Electric Corp.'s pole-type distribution transformers 100 kva and smaller and 15 kv and below. Addition by the manufacturer of synthetic inhibitors is said to greatly increase oxidation resistance of Wemco-C oil used in these transformers, more than trebling the life of the oil.

Additions of these inhibitors in no way affects electrical characteristics of the oil. It will mix with other good inhibited oils. When mixed with uninhibited oils or used oils, life

BOOST BOILER EFFICIENCY

BY USING THE *Simplified* **FYRITE CO₂ INDICATOR**



ACCURATE Flue Gas Tests in 40 Seconds!

FYRITE CO_2 readings instantly expose fuel wasted up the stack, indicating necessity of making adjustments that will secure the most efficient combustion. The FYRITE also helps detect heat losses due to air leaks in boiler settings, etc. It is indispensable to "cross-check" automatic combustion controls, and to assure proper compensating adjustments in the fuel-air ratio. The FYRITE is simple, sturdy; has no glass parts, no delicate electrical system.

Write for Bulletin 740

Instrument is packed in steel chest complete with gas sampling accessories

Also Available!
OXYGEN INDICATOR
for DIRECT Oxygen Analysis

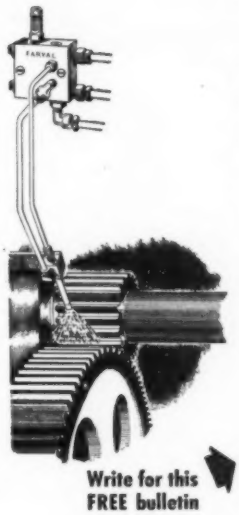
Employs FYRITE principle . . . Accuracy not affected by temperature and atmospheric conditions, or by presence of other gas in sample.

Ask for Leaflet 700

BACHARACH
Industrial Instrument Co.
7000 BENNETT ST.
PITTSBURGH 8, PA.

New Farval Spray Valve

METERS LUBRICANTS TO SLIDE SURFACES AND OPEN GEARING



BY an ingenious adaptation of the familiar Farval Dualine Valve, either grease or oil is sprayed through a nozzle—onto any desired area, in any amount, at any interval.

The new Farval Spray Valve can be added to a regular Farval Dualine Lubrication System wherever compressed air is available—or a complete system of spray valves may be installed, served by either manual or automatic pumping unit.

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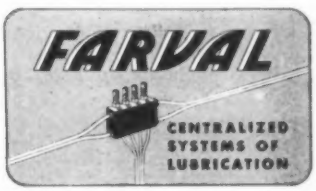

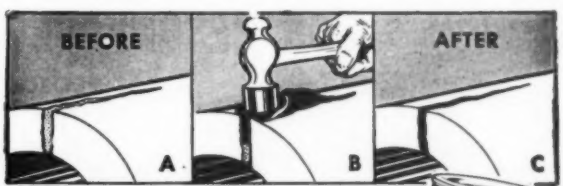

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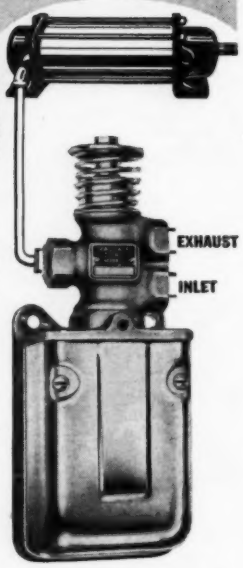

. . . and its dependability is due to many quality features. *Examples*: the "O-U" packer, no metal seats, heavy solenoid and standard pipe area through valve, permitting unrestricted air flow and preventing pressure loss. Yet Valvairs cost no more.

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would be decreased by dilution of the inhibitor and by the oxidation products already present. While synthetic inhibitors are removed to a slight degree by filtering through such agents as activated carbon, clay, alumina and silica gel, a moderately refined base oil will retain the major part of its natural inhibitors and still show its usual long life, it is claimed by company engineers.

New General Office and Factory Building To Be Ready for 60th Anniversary

Scheduled for completion early next summer in time for the company's observance of its 60th anniversary, construction has begun on The Powers Regulator Co.'s new office and factory. The building, which will contain 130,000 sq ft, is rising on a 13 acre site in Skokie, Ill. Sessions Engineering Co. of Chicago are the architects and engineers.

The new building will be 575 ft long, with a two-story office, test and research laboratory section 290 ft wide constructed of face brick and stone. Products manufactured in this new plant will include the company's line of automatic temperature and humidity controls for heating, air conditioning and industrial processes, and thermostatic controls for water heaters, shower baths and hospital therapy.

Water Supply Available for Fire Protection Shown in Miniature for Fire Prevention Week

A miniature fire protection system was used during Fire Prevention Week and the month of October to demonstrate fire safety precautions to Caterpillar Tractor Co. safety supervisors and other personnel.

Planned by the safety and plant protection divisions of the company, the display model showed sources of water for

"TROUBLE FREE" Control . . .

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fighting fires in the plant. Action was provided by a sprinkler head which could be fired so that water was sprayed from a five-gallon tower into a miniature "factory."

Represented in the network of pipes which dominated the display were four sources of water available for fire fighting at the plant, including the East Peoria Water Works as well as Caterpillar's reserve and wells.

TAINTER GATES ON WAY TO BRAZIL

Structural steel tainter gate for two new hydroelectric and flood control dams on the Sant'Ana and Santa Cecelia Rivers near Rio de Janeiro, Brazil, is ready for shipment at the Dravo Corp. plant. Ten gates are 60 ft long while one is 11 ft long. They will control the flow through the spillways

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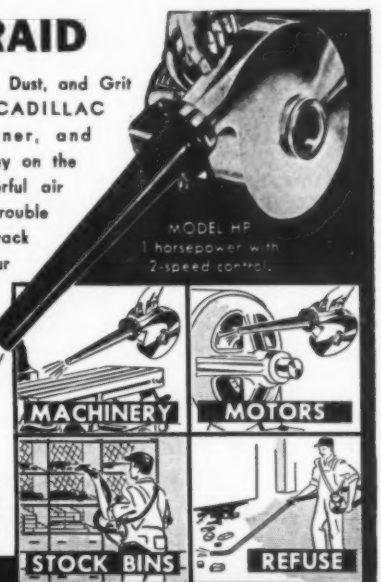

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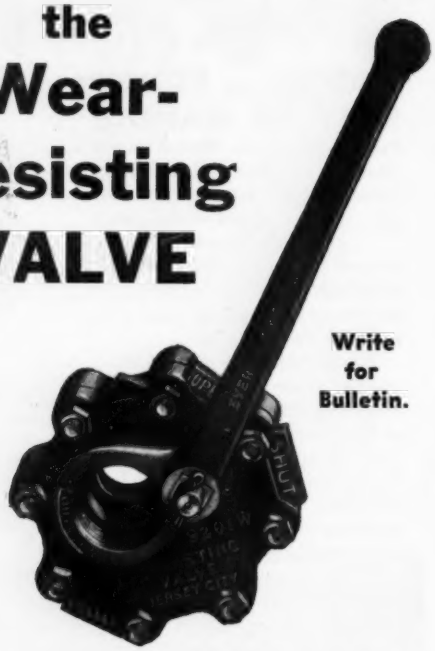

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for everlasting protection

First Non-AEC Nuclear Reactor Will Be Built at North Carolina State College

The first non-AEC owned and operated nuclear reactor in the United States will be built by the Consolidated University of North Carolina, using nuclear fuel loaned by the Atomic Energy Commission.

The proposed reactor, which will provide facilities for nuclear engineering research and education, will be located on the campus of North Carolina State College at Raleigh. Present design calls for a low-power reactor having a maximum power level of 10 kw, which will use enriched fuel containing not over one kilogram of fissionable uranium 235.

The North Carolina reactor will be a "water boiler" type, similar to one that has been in operation at the Los Alamos scientific laboratory since 1944. The significant feature of the water boiler design is that the uranium fuel is a solution of uranium salt in water. Such reactors are also called homogenous reactors as contrasted to reactors in which metallic uranium fuel elements are used. At Los Alamos the water boiler has proved of great value for research purposes.

The plutonium production of the proposed reactor will total less than a gram a year, an insignificant production rate in the manufacture of atomic weapons. In view of this fact and since the reactor will be useful in the conduct of research and training, the private construction, operation and ownership is permissable under the Atomic Energy Act.

The cost of the reactor, exclusive of the uranium fuel to which AEC will retain title, is estimated at $100,000, which will be provided by the college. Some 60 undergraduate and graduate students in nuclear engineering are enrolled at the college this semester.

Rubber Avenue in Naugatuck, Conn., Lives up to Name, Paved with Rubber

They have paved Rubber Avenue with rubber in the town that can lay claim to being the cradle of the rubber industry! Naugatuck, Conn. is the site of the factory which, in 1843, produced the first rubber product under the original vulcanization patent of Charles Goodyear. Rubber Avenue is one of the main streets in the community.

The street was recently resurfaced with a combination of asphalt and meltable rubber compound developed by Naugatuck Chemical Div. of the United States Rubber Co. Local highway officials expect the pavement to give at least twice the wear of straight asphalt resurfacing material. It is also expected to reduce maintenance costs. When the new rubber compound is added to asphalt, elasticity and durability are greatly improved, resulting in a more serviceable, lower cost road, Naugatuck Chemical officials predict.

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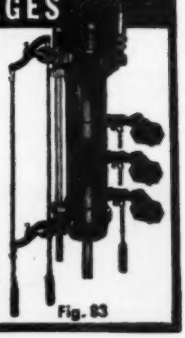

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Fig. 83

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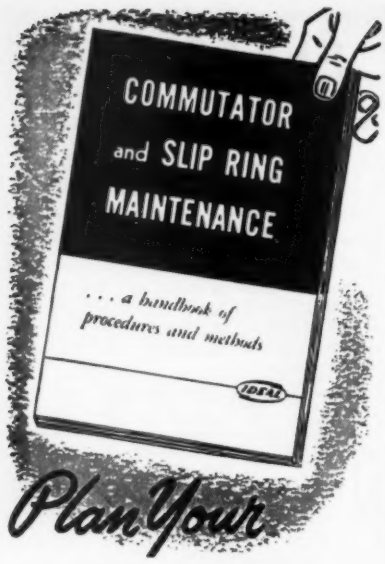

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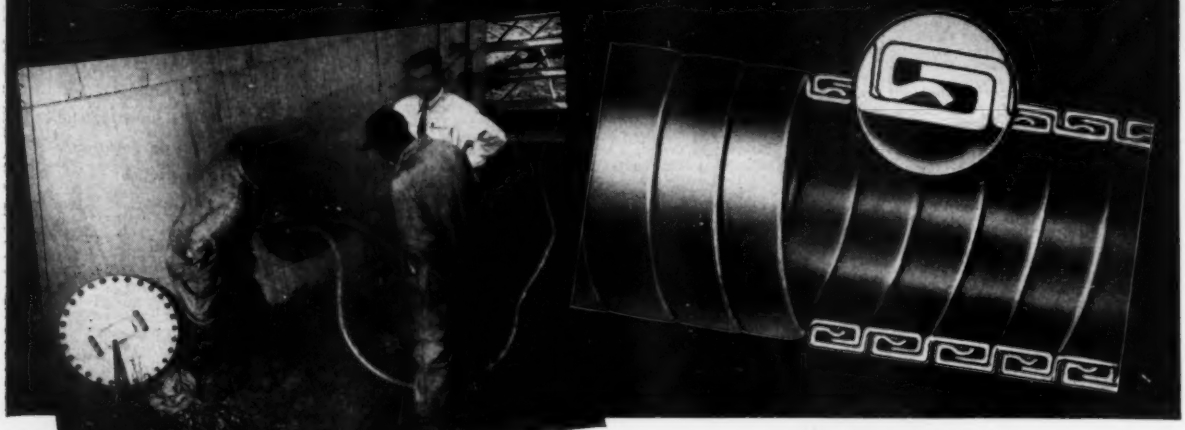

Top photo—CMH REX-TUBE Type RT-15 being used to steam out a storage tank. Middle photo—CMH REX-TUBE Type RT-15 used as a gas connection for a furnace. Bottom photo—CMH REX-TUBE Type RT-15 used for unloading a tank car.

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